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PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

BUREAU OF MINES

Honourable J. E. PERRAULT, Minister -- S. DUFAULT, Deputy-Minister

THÉO. C. DENIS, Superintendent of Mines

REPORT ON

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1920

QUEBEC
LS.-A. PROULX
PRINTER TO HIS MOST EXCELLENT MAJESTY THE KING

1921

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Province of Quebec

DEPARTMENT OF COLONIZATION, MINES AND FISHERIES

To the Honourable J. E. Perrault,

Minister of Colonization, Mines and Fisheries,
Quebec.

Sir,—

I have the honour to transmit to you the "Report on the Mining Operations in the Province of Quebec" for the year ending December 31st, 1920. This publication is the annual report of the technical branch of the Bureau of Mines.

I remain, Sir,

Your obedient servant,

S. DUFAULT,
Deputy-Minister.

Quebec, May 4th, 1921.

Province of Quebec

DEPARTMENT OF COLONIZATION, MINES AND FISHERIES

BUREAU OF MINES

Mr. S. Dufault,
Deputy-Minister of Colonization,
Mines and Fisheries, Quebec.

Dear Sir,—

I beg to transmit to you the Annual Report of the Bureau of Mines of the Department, for the year ending December 31st, 1920.

This report entitled "Mining Operations in the Province of Quebec during 1920", gives the statistics of production of the mines and quarries; of labour employed in the mining industry in the Province; of mining accidents which occurred; a synopsis of the mining operations and development during the year.

As in the past years, the "Report on Mining Operations in the Province of Quebec in 1920", was preceded, on February 24th, by a statistical statement of the mineral production, giving provisional figures subject to revision. The present report gives the revised statistical figures, and the tables in this volume supersede those of the preliminary statement.

Yours very obediently,

THÉO. C. DENIS,
Superintendent of Mines.

Quebec, May 4th, 1921.

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NOTE

In the statistical tables and in the review of the mining industry of the Province during the year, the term "production" is synonymous with "quantity sold or shipped", and does not necessarily represent "output". The ore and other mineral products remaining as "stock on hand" at the end of the year are not included in the production figures.

The ton used throughout is that of 2,000 lb., except when specially mentioned.

The year referred to is the calendar year, ending December 31st, unless specially stated.

We endeavour to give values of the mineral products, raw or prepared, as estimated at the point of shipment or at the pitmouth; this, however, is sometimes difficult to obtain with accuracy.

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING 1920

The value of the products of the mines and quarries operated during 1920 in the Province of Quebec reached a record figure of $28,392,939. This is the highest figures yet attained and the upward trend of our mineral production has been continuous for the last six years. As compared with the preceding year, when the value of the production was $20,813,670, we record an increase of $7,579,269, or 36.4 %. If we go back 20 years and take the value of the mineral production recorded in 1900 which was $2,546,076, we observe that the mineral industry of the province has grown more than ten-fold in that period.

The prosperous state of our mining industry during 1920 is a matter of congratulation, for the world, as a whole, is still in the throes of a process of readjustment towards normal conditions, after the more than four years of warfare during which most of the efforts of production went to satisfy the needs of war, and when costs were a very secondary consideration.

The diversion of products to peace uses, and the stoppage of their waste, necessarily threw on the market large surpluses which had accumulated in 1919, following the armistice, and during the last two years the process of readjustment has been marked by an

industrial and commercial depression which has caused the closing down of many plants. Metals have been especially affected in 1920. Copper fell from 19 cents to $12\frac{1}{2}$ cents; lead from $8\frac{3}{4}$ cents to 5 cents; zinc from $9\frac{1}{4}$ to $5\frac{1}{2}$; silver from $\$1.32\frac{3}{4}$ to 70 cents. The costs of operation, and especially the exigencies of labour, were barely reduced from the high prices which prevailed during the preceding years, and as a consequence all metallic mines had to reduce production and many entirely stopped operating.

At the end of the year the wave of depression which is sweeping over the world had not yet reached its lowest point, but better conditions in a near future were hoped for, and active resumption of business was expected.

Several of our mineral products have felt the adverse effects of this readjustment period. The output of the province in copper and sulphur ores, and lead ores, show decreases; mining of molybdenite, which was so active during the war, has now been discontinued; although the shipments of chromite show a slight increase as compared with 1919, yet towards the end of the year, the industry was fast declining owing to the resumption of production of this mineral in South Rhodesia and New Caledonia.

Fortunately the asbestos industry more than held its own during the first ten months of the year, and although in November and December, the demand had become less keen, and the American market appeared to have become nearly satiated, the shipments for 1920, both in tonnage and in value, reached record figures.

In 1920 the value of the metallic products of our mines only figure for $483,888, or 2% of the whole. This is a decrease as compared with 1919, when they amounted to $1,014, 088, or 5% of the mineral production, and to $2,855,120, or 15% in 1918.—On the other hand the non-metallics, at the head of which appears asbestos, show very gratifying results. Asbestos, Magnesite, Mica, Graphite, Silica, Kaolin, and other minor products represent a value of $15,771,852, or $55\frac{1}{2}$%, as compared with $11,709,341, or 56% in 1919. Building materials show the largest proportional

increase, as they figure for $12,054,857, or 49% instead of $8,090, 241 or 39% in the preceding year.

TABLE OF VALUE OF ANNUAL MINERAL PRODUCTION OF QUEBEC, FROM *1900* TO *1920*

YEAR	VALUE	YEAR	VALUE
1900	$ 2,546,076	1911	$ 8,679,786
1901	2,997,731	1912	11,187,110
1902	2,985,463	1913	13,119,811
1903	2,772,762	1914	11,732,783
1904	3,023,568	1915	11,465,873
1905	3,750,300	1916	13,287,024
1906	5,019,932	1917	16,189,179
1907	5,391,368	1918	18,707,762
1908	5,458,998	1919	20,813,670
1909	5,552,062	1920	28,392,939
1910	7,323,281		

As during the preceding years comparatively little prospecting was done, owing to the high cost of supplies on one hand, and the very attractive wages offered in several of the industries on the other hand. Common labour in mines, both in Ontario and Quebec was paid $4.50 to $5.00 a day. Lumber and pulpwood men in the bush commanded $150 a month and board; some of the labourers and miners in the asbestos mines made $60 a week on contract work. So that under these conditions it is not to be wondered at that prospecting, with its uncertainties of returns, did not attract many followers. But with the return of more normal conditions and prices there is no doubt that prospection will regain some of its former activity.

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1920

Substances	No. of workmen	Wages	Quantities	Value in 1920	Value in 1919
		$		$	$
Asbestos, tons	3,795	4,846,010	179,891	14,749,048	10,932,289
Asbestic, tons	.....	.....	19,716	43,559	63,011
Chromite, tons	143	145,629	10,585	247,730	223,331
Copper and Sulphur ore, tons	123	96,640	15,186	98,854	447,623
Feldspar, tons	30	9,459	849	11,252	11,665
Kaolin, tons	20	17,808	874	16,681	13,744
Gold, oz	10	4,730	935	19,346	29,420
Graphite, lb	69	55,766	466,420	31,913	400
Iron ore, tons	.....	.....	.....	.....	.....
Titaniferous Iron ore tons	8	2,328	960	2,999	.....
Magnesite, tons	210	175,301	17,941	512,755	283,719
Marl, tons	12	1,769	.....	.....	.....
Mica, lb	180	101,975	1,496,399	281,729	224,988
Mineral water, gals.	9	5,318	20,811	9,962	12,608
Mineral paints (iron oxide, ochre), tons	80	63,313	19,185	136,098	111,645
Molybdenite, lb	17	5,927	.....	.....	69,203
Peat, tons	.....	.....	.....	.....	4,811
Phosphate, tons	.....	.....	.....	.....	300
Quartz & Silica, tons	79	46,597	24,865	60,147	50,161
Silver, oz	.....	.....	57,514	58,032	141,373
Talc, tons	6	400	150	1,050	.....
Zinc and Lead ore, tons	184	120,122	3,015	56,927	103,138
Building Materials					
Brick, M	891	934,817	129,440	1,956,473	1,179,624
Cement, bbls	869	1,351,486	3,103,463	6,545,053	4,337,572
Granite	286	321,744	.....	494,372	334,692
Lime, tons	233	243,378	60,301	682,477	521,031
Limestone, tons	1,089	867,519	988,209	1,584,316	916,776
Marble, c. ft	129	165,151	25,250	228,353	192,489
Sand, building, tons	151	85,692	397,508	206,433	180,987
Sandstone, tons	37	19,385	20,139	21,910	3,850
Slate, square	48	37,372	.....	14,200	10,853
Tile, drain and sewer pipe, pottery, etc.	98	94,795	.....	321,270	412,367
Totals	8,806	9.820,431	.....	28,392,939	20,813,670

NOTICES AND REPORTS BY MINE OPERATORS TO THE DEPARTMENT

The Bureau of Mines, among its functions, collects and compiles the statistics of the mineral production of the Province, and has charge of the inspection of working mines and quarries, from the standpoint of the safety of the workmen. The Department, has to keep in close touch with the operators of mines and quarries, and they are under obligation, by various provisions of the Quebec Mining Law, to give certain notices and make reports to the Department. As all may not be sufficiently familiar with these statutory regulations, we reproduce here various articles of the Law dealing with these rules:—

Article 2163.—Every owner of mining rights, whether he mines himself or by others, and every person working mines shall, during the first ten days of January in each year, furnish a sworn statement of his operations of the past year, mentioning the quantity of mineral extracted, its value at the mine, the quantity and value of the marketable product, and the number of workmen employed, as well as a list of the names of persons killed in working the mines. R. S. P. Q. 1498; 1 Ed. VII, c. 13, s. 5; 9 Ed. VII, c. 27, s. 12.

Article 2192.—Every person who commences to operate a mine or quarry, or who, after a suspension of six months, resumes operations already begun by himself or by others, is bound, under penalty of a fine of not more than twenty-five dollars, and costs, and in default of payment, to imprisonment for not more than one month, to give the Minister a notice in writing setting forth:—

1. The name and address of the person carrying on the operations;

2. The locality and the description of the land on which such operations are carried on;

3. The nature of the ore and mineral which is the object of the operations. R. S. P. Q., 1528; 55-56 V., c. 20, s. 1; 9 Ed. VII, c. 27, s. 13; 6 Geo. V., c. 19, s. 3.

Article 2213a.—If while a mine or quarry is being worked, an accident takes place resulting in loss of life or serious injury, the person working the same or his representatives at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirements of this article, shall be liable to the penalties provided in article 2207.

CHEMICAL LABORATORY

The Quebec Bureau of Mines maintains at the Polytechnic School, of the University of Montreal, 228 St. Denis street, Montreal, an up-to-date equipped laboratory, for the convenience of the interested public. Analyses and assays, determinations of minerals and tests of various ores, samples, and materials found within the boundaries of the Province of Quebec, are made in this laboratory at prices which are extremely low for the high-grade work done. The laboratory has been established for the sole purpose of aiding the development of the mineral resources of the Province of Quebec. Prospectors and all persons interested in the Quebec mineral resources are cordially invited to avail themselves of the facilities offered. The tariff in force for the analysis and assay of various substances is given further on, and it will be realized that the fees are very low as the high competence of the chemists ensure results of undoubted reliability.

During the year ending December 31st, 1920, the Provincial Laboratory effected 960 analyses and assays, as follows:—

Gold, 297; Silver, 290; Aluminium, 35; Antimony, 1; Ash 4; Carbon, 1; Combined Carbon, 1; fixed Carbon, 4; Chrome, 1 Combustions, 24; Copper, 14; Graphite, 6; Iron, 59; Lead, 16; Lime, 32; Magnesia, 8; Manganese, 4; Moisture, 6; Molybdenum, 4; Nickel, 19; Platinum, 3; Phosphorus, 3; Potash, 2; Calorific power, 4; Silica, 42; Silicon, 1; Soda, 2; Sulphur, 13; Tin, 1; Titanium, 5; Zinc, 16; Qualitative tests, 35; Water of combination, 2; Volatile matter, 4; Organic matter, 1.

Province of Quebec

GOVERNMENT ASSAY LABORATORY

(Under the direction of the Department of Mines of the Province of Quebec as an aid to the development of the mineral resources).

TARIFF OF FEES FOR ASSAYS AND ANALYSES

DETERMINATIONS	Less than 5 samples Each:	For 5 samples or more Each:
	$ Cts.	$ Cts.
Moisture	0.25	0.25
Combined Water	0.50	0.50
Gold and Silver	1.00	0.90
Silica, Copper, Iron — 1 constituent	1.00	0.90
Silica, Copper, Iron — 2 constituents in same sample	1.75	1.50
Iron, in titaniferous ore	2.00	1.80
Graphite, Alumina, Lime, Magnesia, Sulphur, Lead, Nickel, Cobalt — 1 constituent	1.50	1.35
Graphite, Alumina, Lime, Magnesia, Sulphur, Lead, Nickel, Cobalt — 2 constituents in same sample	2.50	2.25
Antimony, Zinc, Manganese, Chromium, Titanium, Arsenic, Phosphorus, Platinum, Bismuth — 1 constituent	2.00	1.80
Antimony, Zinc, Manganese, Chromium, Titanium, Arsenic, Phosphorus, Platinum, Bismuth — 2 constituents in same sample	3.50	3.15
Commercial analysis of an iron ore, comprising determination of silica, iron, phosphorus, titanium and sulphur	6.50	5.85
Commercial analysis of a limestone or cement, comprising: silica, lime, alumina, magnesia, and sulphuric acid	6.00	5.40
Commercial analysis (proximate analysis) of a fuel, comprising: ash, volatile combustible, fixed carbon, moisture	3.00	2.70
Calorific power of a fuel	1.50	1.35
Radioactivity of a mineral	1.00	0.90
Radioactivity of a mineral water	2.00	1.80

DETERMINATION OF MINERALS.—For a nominal fee of 25c. for each sample, the laboratory will make determinations of ores and minerals, provided rapid tests will allow it, and issue a report on probable contents and commercial value of specimens and samples.

TERMS.—Money in payment of fees, by registered letter, postal notes or orders, must invariably accompany the samples, in order to insure prompt return of certificate.

Remittances by money order or accepted cheque, payable at par in Montreal, should be made out to the order of PROVINCIAL ASSAY LABORATORY, not to any individual.

Professor AD. MAILHIOT,
In charge of Laboratory
No. 228, St. Denis St., Montreal.

MINING OPERATIONS

ASBESTOS

The demand for asbestos was well sustained throughout the year, and we record for 1920 the highest figures of production of this mineral, both in tonnage and in value. These reached 179,891 tons, valued at $14,749,048 or an increase of 32.3% in quantity and 35% in value as compared with the previous year when the shipments amounted to 135,862 tons valued at $10,932,289. These figures are exclusive of the "Asbestic", a by-product consisting of very short fibre and rock dust, recovered in the course of the milling of the asbestos rock, which amounted to 19,716 tons valued at $43,559, in 1920, and 23,827 tons valued at $63,011, in 1919.

The previous largest tonnage was produced in 1918 when 142,375 tons was shipped, the value of which amounted $9,019,899.

During the first nine months of the year the supply could hardly keep up with the demand and in September there were practically no stocks on hand in the mine sheds.

But towards the end of the year the market became easier, owing to the decrease in industrial activities in the United States and on December 31st 1920, the stocks on hand at the mines amounted to 23,361 tons valued at $2,432,348, as compared with 32,752 tons valued at $3,026,766, on December 31st 1919.

During the months of January and February of 1921, the industrial depression was accentuated and the activities of the producing mines were noticeably curtailed.

The quantity of rock mined and hoisted was 3,123,370 tons, from which was extracted a quantity of 170,500 tons of merchantable fibre, some of which remained as stock on hand at the end of the year. This corresponds to an extraction of 109.1 lb. of fibre per ton of rock mined, of a value of $4.53.

The following tables give the detail of the production of asbestos during the two years 1920 and 1919.

It will be noticed that for the year 1920, we have grouped the mill stock qualities of fibre according to their industrial uses, instead of the indefinite classification which we used in previous years of Mill Stocks No. 1, No. 2 and No. 3.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1920.

Designation of Grade	Shipments and Sales		Average Value per ton	Stock on hand Dec. 31st. 1920	
	Tons	Value		Tons	Value
Crude No. 1	1,026	$1,513,439	$1,475.08	446	$ 659,259
Crude No. 2	2,830	2,296,302	811.41	854	829,438
Spinning Fibre	14,068	3,933,918	279.63	1,929	653,115
Shingle Fibre	16,784	1,852,210	110.35	1,306	172,476
Paper Stocks and others	145,183	5,153,179	35.49	18,826	118,060
Totals	179,891	$14,749,048	81.99	23,361	2,432,348
Asbestic	19,716	43,559	2.20	125	274
Totals	199,607	$14,792,607	.....	23,486	$2,432,622

Quantity of rock mined during the year:—3,123,370 tons.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC IN 1919

Designation of Grade	Shipments and Sales			Stock on hand Dec. 31st 1919	
	Tons	Value	Average Value per ton	Tons	Value
Crude No. 1	1,103	$1,385,627	$1,256,.74	366	$ 455,308
Crude No. 2	2,991	1,850,605	618.77	937	539,608
Mill Stock No. 1	13,764	3,057,695	222.15	3,965	752,388
Mill Stock No. 2	69,868	3,704,321	53.02	17,439	989,531
Mill Stock No. 3	48,136	933,941	19.40	10,045	289,931
Totals	135,862	10,932,289	80.47	32,752	3,026,766
Asbestic	23,827	63,011	2.64	1,009	3,999
	159,689	10,995,300	.....	33,761	$3,030,765

Quantity of rock mined during the year 1919:—3,061,690 tons.

TABLE OF DATA OF THE QUEBEC ASBESTOS INDUSTRY

FOR THE TEN YEARS 1911-1920

Year	Fibre shipped Tons	Total value $	Average value per ton $	Rock mined tons	Asb. content per ton of rock.—lb.	Average value of content of rock $
1911	102,224	3,026,306	29.60	1,583,076	107.8	1.53
1912	111,175	3,059,084	27.52	1,870,608	108.6	1.38
1913	136,609	3,830,504	28.04	2,527,410	105.4	1.45
1914	107,401	2,895,935	26.96	2,127,395	111.4	1.43
1915	113,115	3,544,362	31.33	2,134,073	96.9	1.46
1916	133,339	5,182,905	38.87	2,291,087	102.6	2.12
1917	137,242	7,198,558	52.45	2,634,410	108.7	3.08
1918	142,375	9,019,899	63.35	2,445,745	117.3	4.08
1919	135,862	10,932,289	80.47	3,061,690	100.8	3.88
1920	179,891	14,749,048	81.89	3,123,370	109.1	4.53

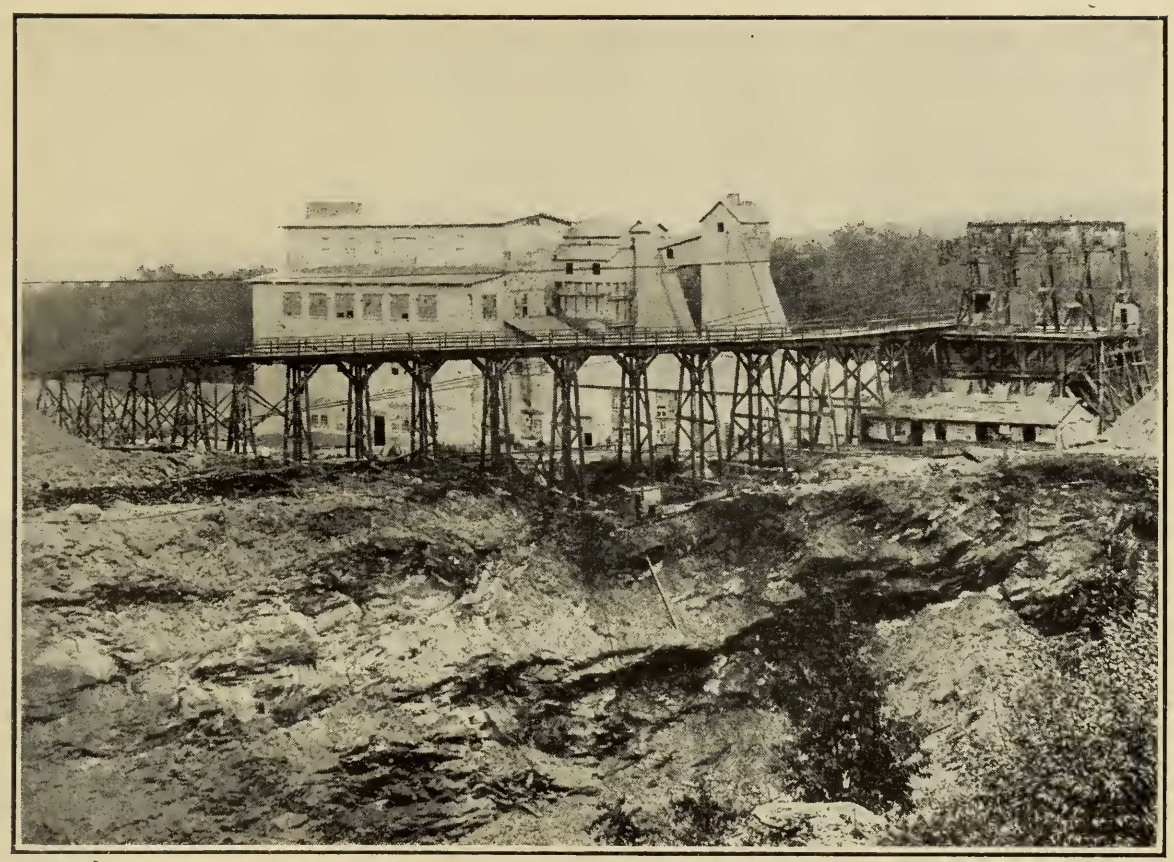
The greater part of our asbestos is exported in the unmanufactured state, the great bulk of it going to the United States, as will be seen by the table of exports, compiled from the official returns of the Canadian Customs Department.

EXPORTS OF CANADIAN ASBESTOS

FOR TWELVE MONTHS ENDING DECEMBER 31ST, 1920

Crude Fibre and Mill Stock

	Tons		*Value*
United Kingdom	11,881	$	1,270,172
United States	115,283		7,955,772
Australia	483		49,895
Belgium	8,251		698,615
France	2,011		216,867
Germany	3,265		396,933
Italy	2,390		290,609
Japan	4,863		293,344
Netherlands	1,695		152,783
Spain	440		32,650
Switzerland	5		390
Other countries	2,173		163,506
Total	152,740		$11,521,536



Asbestos Corporation Co. of Canada, Ltd.—Fraser mine and mill, East Broughton, P. Q.

Asbestos Sand and Waste

	Tons	*Value*
To United Kingdom	30	$ 300
To United States	36,218	364,520
Other countries	55	1,100
Total	36,303	$365,920

Royalty on Asbestos.—On March 7th 1917, an Order-in-Council was passed decreeing, in conformity with article 2105, of the Revised Statutes of the Province of Quebec, 1909, that a Royalty of 5%, after deducting working costs, be collected on all asbestos produced from the mines in the Province after April 1st 1917.

Later, on April 27th, the producers of asbestos unanimously proposed to the Government of the province, that the above Royalty, or tax, be changed into a Royalty of 2% on the gross value of the asbestos extracted, sold or shipped in the Province or out of it.

An agreement was therefore entered into between the producers of asbestos, and the Government, and on May 15th a new Order-in-Council was passed decreeing:

1st.—That from the 1st of May 1917, the Royalty on asbestos shall be 2% of the gross value of this mineral extracted from the mines of this province.

2nd.—That this Royalty shall be payable semi-annually, on the 30th of June, and the 31st of December respectively, to the Department of Colonization, Mines and Fisheries."

The average value per ton of the asbestos produced in 1917 showed an advance to $52.45, as compared with $38.87 for 1916. Considering the very prosperous state of the asbestos industry the

Government decided to increase the Royalty, and on May 3rd, 1918, an Order-in-Council was passed increasing the Royalty to 3½% on the gross value at the mine of all asbestos shipped on and after June 1st 1918.

During the years 1918 and 1919, the asbestos industry was very active and the average market price per ton rose to $63.35 for 1918 and to $80.47 in 1919, which were unprecedented figures, an advance of more than three times the price of 1914 which was $26.96. In view of this, an increase of 1½% on the royalty was decided, and on March 12th 1920, an Order-in-Council was passed, advancing the rate of the royalty to 5% of the gross value, at the mine, of all asbestos shipped after March 15th 1920.

Asbestos Mining in 1920.—Returns of shipments of asbestos were received from 17 companies, operating 21 mines during 1920:

Asbestos Corporation of Canada, Ltd., Thetford Mines, P. Q.
Asbestos Fibre Mining Co., East Broughton, P. Q.
Asbestos Mines, Limited, East Broughton, P. Q.
P. E. Beaudoin, Thetford Mines, P. Q.
Bell Asbestos Mines, Thetford Mines, P. Q.
Bennett-Martin Asbestos & Chrome Co. Ltd., Thetford Mines, P. Q.
Black Lake Asbestos & Chrome Co. Ltd., Black Lake, P. Q.
Canadian Johns-Manville Co. Ltd., Asbestos, P. Q.
Consolidated Asbestos, Limited, Thetford Mines, P. Q.
Federal Asbestos Company, Robertsonville, P. Q.
General Asbestos Co. Ltd., East Broughton, P. Q.
Johnson's Company, Thetford Mines, P. Q.
Maple Leaf Asbestos Corporation, Thetford Mines, P. Q.
Pennington Asbestos Company, Robertsonville, P. Q.
Jos. Poulin, East Broughton, P. Q.
Quebec Asbestos Corporation, East Broughton, P. Q.
Ross, Frank W., 92 St. Peter street, Quebec. (1)

Apart from the operation of the twenty-one mines, by the

(1) Shipped from old stock. Mine idle since 1910.

Bennett-Martin Asbestos and Chrome Mines, Ltd.—Thetford Quarry.—Method of development for cable-derrick hoisting of rock

seventeen companies above mentioned, reports were received of prospecting and development work done on nine other properties, in East Broughton, Coleraine, Black Lake, and in Bolton township, indicating a year of unprecedented activity in the asbestos industry.

The Asbestos Corporation of Canada, Ltd., operated four mines: —the King mine and the Beaver mine, at Thetford; the British-Canadian mine, at Black Lake; and the Fraser mine at East Broughton.

The production of the King and the Beaver mines was somewhat interfered with by a strike of the miners, which was called on October 11th and terminated on November 15th, 1920. The question at issue was an increase of the minimum wage of unskilled labour. Although the strike lasted over one month, it was not characterized by any serious disorder, and it did not spread to the other mines. The men resumed work at the old minimum rate of $4.25 a day.

At the King mine, or quarry, the depth of the open-cast pit is now more than 300 feet from the surface. Another cable-derrick has been added to the hoisting equipment, making five derricks in continuous use. These five hoisting apparatus are similar in all respects. They have been fully described in previous reports.

A contract has been awarded for 20,000 feet of diamond-drill holes, to prospect and block out ore on the property on which the King mine is situated, lots 26 ranges V and VI of Thetford township. The work is being done by the Sudbury Diamond Drilling Company, who have had five drills in continuous operation since May, 1920. It is expected that drilling will be carried on during the greater part of 1921. The results have been eminently satisfactory, and it was reported that by the end of 1920, reserves of milling rock had been blocked out sufficient for thirty years operation at the present rate of output.

A start was made at this mine for the renewal of the overburden immediately to the north east of the King pit, to extend the quarrying operations in that direction. The area to be thus

stripped to the solid serpentine rock, measures approximately 1,300 feet by 1,000. In some places this cover reaches a thickness of over 60 feet. The contract for this work was awarded to the Fraser-Brace Company, and most of the preparations were completed before the end of the year. As this work cannot be economically carried on during the winter, it was discontinued in December to be resumed actively in the early spring.

The minimum quantity of overburden to be removed is 600,000 cubic yards. This is being done by hydraulic transportation. A pump, with a capacity of 3,500 gallons a minute, will pump water from the Thetford river, through a pipe of 20″, 3,000 feet long and discharge it by giant nozzles, to disintegrate the clay and gravel, the resulting mud flowing to a hole, or sump, from which a pump of 6,000 gallons a minute will force it through a pipe line to the end of the dumping grounds of the company, 4,000 feet distant, beyond the Thetford river. Wooden pipes, reinforced by close iron hoops, are used both for pumping the water and for conveying the mud.

All the steam locomotives, both for the rock-yard (conveying the rock to the crushers) and for the dump, have been replaced by electric locomotives. This step was taken owing to the uncertainty of the coal supply. Fuel is used only for the dryer. The rock hoisted at the King mine amounts to 1,800 tons per day of 24 hours. All this, less the weight of the asbestos extracted has to be carried away to the dumps, which now extend to a distance of 3,500 feet from the mill, and they contain several million cubic yards of crushed serpentine. The question of transportation and the disposal of all this material is serious, and the step taken in replacing the steam locomotives by electric ones has already effected a very substantial saving, apart from the consideration of the uncertainty of the coal supply.

At the British Canadian mine, at Black Lake, development work has been pushed actively all the year, and the previous method of hoisting the rock by cable-derrick will soon be entirely superseded by the glory-hole method and underground haulage. As briefly described in our last year report the topography is well

adapted to this method, the main haulage tunnel being an adit, the portal of which is at a higher level than the crusher bin; this eliminates all hoisting of the rock. The British Canadian mine, as it is now understood, comprises the workings of the old British-Canadian, the Standard and the Dominion mines, all adjacent and now connected by a system of tunnels. The total length of haulage ways, tunnels and drifts is now 5,000 feet, the ore from all the workings being treated in one large mill of 1,000 tons of rock capacity per two shifts. The main tunnel which is 2,718 feet long, extends from near the crusher house to a point under the old Upper works. At a point 1,100 feet from the portal a branch tunnel has been driven south 2,038 feet, as far as the Standard pit. At various points raises have been driven to the surface, or to the bottom of the old pits, for "glory-holes".

During the year rock was drawn only from the glory-holes served by the main tunnels. In the Standard pit the rock was hoisted to the surface by cable-derrick and hauled to the crusher by the surface railway, a trolley-electric locomotive being used. This is only temporary, however. The bottom of the pit is being widened, and as soon as the necessary space is obtained, all hauling will be done underground by the branch tunnel. All hauling will then be by electric locomotives and will be done through the tunnels. The mine cars hold five tons of rock, which are dumped into the crusher bin.

The crusher house was considerably improved during the year The new jaw-crusher, 36″ by 42″, crushes to 5″. This is further reduced to $2\frac{1}{2}$ inches by three jaw crushers 15″ by 20″. Then the rock is further reduced by a hammer crusher, before going through vertical dryers, of which there are two. It is then conveyed to the ore bin of 25,000 tons capacity, which was completed this year, similar to the King mine storage bin. On the conveyor belt which carries the rock from the bin to the mill, an automatic electric weighing scale has been installed, which continuously computes and records the tonnage carried by the belt.

The Fraser mine, at East Broughton, another property of the Asbestos Corporation of Canada, was worked continuously until November, when operations were suspended until spring.

Early in 1920, the Jacobs Asbestos Mines Co., changed hands and was taken over by a new organization, the *Consolidated Asbestos Limited*. The name Jacob's Mine has been changed to Thetford Mine.

Underground development at this mine was pushed actively during the year, more particularly on the second level. The large loading pocket at this level was completed. A large sump was also built, with a capacity of 160,000 gallons of water, for the drainage of the whole mine, the drainage from the first level being effected through a series of six inch shot-drill holes.

The underground haulage, to the loading pockets, is done by storage batteries electric locomotives. The charging installation is underground. It takes 8 hours to charge the batteries.

The Consolidated Asbestos Company has taken an option on the Belmina mine, lots 23 and 24, range II of Wolfestown. A gang of men has been put to prospecting; a cable-derrick and a boiler have been installed. The intention is to put up a mill at an early date. In the meantime some crude asbestos, No. 2 and No. 3, is cobbed and shipped in bags.

The company has also acquired the property of the Berlin Asbestos Company, at East Broughton, and intend to reopen it shortly.

At the *Bell Mine*, the work of driving the new inclined tunnel, to haul the rock from the pit to the mill was proceeded with, but at a distance of some 800 feet, some very bad moving ground was encountered, and it is possible that the plans may be changed, and a new tunnel started. In the meantime the old inclined tunnel is used

The *Bennett-Martin Asbestos and Chrome Mines, Ltd.*, operated both their Thetford mine on lot 27 range V, Thetford, and the Vimy Ridge mine, lots 23 and 24 range III, Ireland. At the latter mine the quarry now measures over 700 feet in length along the side of the hill, and is in more than 100 feet. A railway spur, six miles

long is being built, from a quarter of mile north of Coleraine station to the mine. It was hoped that this might be completed before the end of the year, but owing to the scarcity of labour, it could only be finished to within one mile of the mill. The mine closed in December and changes in the mill were started. The cyclones are being replaced by gyratory crushers to as great an extent as possible. The crushers are less injurious to the fibre than the cyclones, and moreover the rock of the Vimy Ridge mine is perceptibly harder than the Thetford rock, and the life of the cyclone beaters is much shorter here than in the other mills.

During the summer of 1920 the company built 35 cottages of very pleasing appearance, on the west slope of a knoll, about half mile west of the mine, and intends to build 25 more in 1921. The cottages have a concrete foundation, and consist of a frame building, with double sheating, and a layer of building paper covered by asbestos boards. The roofs are of asbestos shingles.

Some prospecting was carried on by this company on lots 27 and 28 range III and IV, near the lake, and the results have been very gratifying. Some 25 to 30 men were at work during the greater part of December, opening up the ground, and a very appreciable quantity of crude was being cobbed and shipped. This prospect is situated a mile and a half east of the Vimy Ridge mine in a straight line, and the construction of a mill is being considered.

The Black Lake Asbestos and Chrome Co., at Black Lake, worked two pits, No. 9 and No. 6. No. 9 pit consists of the merging of the old No. 8 and No. 9 pits, which now form only one. Pit No. 6 is a cut on the west slope of the hill and is situated sixty feet to the west of pit No. 9. It is shallower than the latter, and the two will be connected by a tunnel, which will pass 45 feet below the present floor of No. 6 pit. Hoisting by cable-derrick will then be discontinued in pit No. 6 and rock will all be hauled through No. 9 pit.

The Canadian Johns-Manville Company, operating the Jeffrey mine at Asbestos, near Danville, has carried on its plans of systematic development, as well as its mining operations. As men-

tioned in previous reports the cable-derricks have been entirely eliminated for rock hoisting. The mining is carried on in wide benches; the rock is loaded by steam shovels into cars of standard gauge on the benches and in the bottom of the pit. These cars are made up into trains and hauled to the mill by steam locomotives of 30 and 38 tons. The maximum grade is about 3%. The drilling is done by turbo-rotator drills, of the Denver Rock-Drill Manufacturing Co. These can drill holes up to 40 feet in depth, 2 inches in diameter.

The mills, of which there are three, have a total capacity of 3,000 tons of rock a day. One of these mills, No. 2, the oldest of the series, is not modern and will be shut down as soon as mill No. 4B is completed. The concrete foundations are finished, and it will be a duplicate of mill No. 4.

The company has secured the services of an efficiency and safety engineer, an example which could very profitably be followed by other large operators. Meetings are held and lectures given on "Safety First" for the benefit of the men. A hospital has been organized in charge of a trained nurse.

The *Johnson's Company's* mines, both at Thetford and at Black Lake, were in continuous operation throughout the year.

The *Maple Leaf Asbestos Corporation*, acquired, in October 1920, the rights and property of the Maple Leaf Syndicate, in the Reed mine, on lot 29, range "A", Coleraine township, and commenced the erection of a mill, of a capacity of 200 tons a day. This deposit, which was worked during the whole of the year on a small scale, appears to be very promising, and this led the operators to make new arrangements to extend and increase the activities. The small mill of 50 tons of rock a day, which had been built the previous year by Messrs. Blais and Fillion, has been closed, and it is expected that the new mill will be completed in the spring of 1921.

The Pennington Asbestos Company, working the old Robertson Asbestos Company's mine, lot 16, range IV, Thetford township, at

Robertson, since the middle of 1918, operated actively and carried out important improvements during the year. Considerable changes have been made in the mill, so that its capacity has been increased from 400 tons of rock per shift of 12 hours, to 500 tons. The open pit is now over 100 feet in depth. At the end of the year the company was improving the method of haulage of the rock from the pit to the mill. An inclined way was built from the east end of the quarry to the mill, up which the mine cars will be hauled by a cable and an electric hoist. This will replace the steam locomotives, previously used for haulage, as they are very expensive in maintenance and operating, more specially with the price of coal in the vicinity of $20 a ton.

A few hundred feet east of the open pit new workings have been started. A cable-derrick with a length of cable of 800 feet, has been erected, to haul the rock from this new opening to the mill.

At east Broughton, *The Quebec Asbestos Corporation* has worked its mine without interruption (lot 13 range VI), formerly operated by the Ling Asbestos Company.

In 1918, this company adopted a policy of underground prospecting and development and started a shaft, to the south of the open pit, in the hanging-wall side of the serpentine sheet. This shaft was sunk to a depth of 200 feet, and at a depth of 175 feet, where the serpentine was encountered, two drifts were driven towards the west, of 800 and 925 feet respectively. There are also some short drifts towards the east. From the drift, near the shaft, an incline of 45 degrees and 142 feet long has been driven upwards to the bottom of the main open pit. Through this incline the rock of the underground workings is hauled to the crusher bin, erected in the open pit.

In the open pit the mining of the asbestos rock has been pushed specially towards the south west. The main drilling is done by a Sullivan submarine drill, an apparatus which drills 3 inch holes to a depth of 75 feet. The holes are spaced ten or twelve feet apart, and charged heavily.

The Quebec Asbestos Corporation have acquired the property immediately to the west of their mine. This property, the old Eastern Townships Asbestos Company's mine was worked until December 1920 by the Asbestos Fibre Mining Company, and the band of serpentine is the same.

The Asbestos Mines, Ltd., of which Mr. J. A. Jacobs is the president was organized early in 1920 to work the old property of the Boston Asbestos Company, at East Broughton, lot 13, range V of Broughton. The mill has been overhauled and new machinery set up; it was started in June, and worked continuously during the rest of the year, with the exception of a six week stop in the fall.

At first the asbestos rock was quarried at the old mine, situated to the north-east of the mill, but later a new body of serpentine was opened up, further on, on lot 13*e* of range IV. The rock was hauled to the mill by waggon, but at the end of the year an aerial conveyor over a mile long was being erected. The fibre of this mine is short, but very white and of good quality.

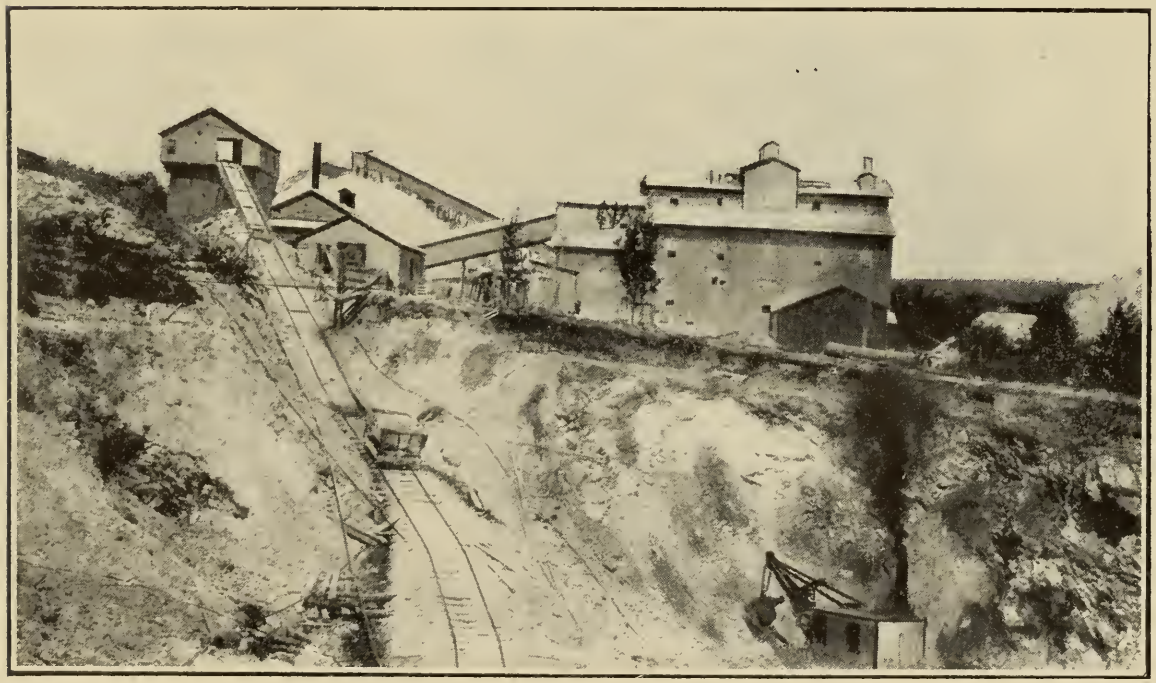
The General Asbestos Company, organized by Mr. S. Cohen, acquired the property formerly worked by Mr. Joseph Poulin, on lots 13 "H" and "I", range VII Broughton. Some new screens and other machinery were added to the mill which had been erected by Mr. Poulin.

Mr. Jacobsen organized the *Asbestos Crude and Fibre Mining Company* to work the old Ward-Ross property, on lot 26, range "B" of Coleraine township, and carried on active development work. At the end of the year a mill was in course of erection.

Prospecting and development work was carried on during the year at various places in the Coleraine, Thetford and East Broughton districts. *Mr. P. E. Beaudoin*, of Thetford Mines, prospected on lot 26, range "A" Coleraine, and on lot 13, range V of Thetford.

The Bolton Mining Company, organized by Mr. John Dugal carried on some work on lot 9, range IX of Bolton township. *The*

Asbestos Manufacturing Co. Ltd.—Montreal, P. Q. Plant for the manufacture of shingles, sheathing, boards and other asbestos building materials, at Lachine.



Asbestos Fibre Mining Co., Ltd.—East Broughton, P.Q.—Steam shovel loading and hoisting by incline.

Canada Asbestos and Chrome Co., Ltd., organized by Mr. Théberge, of Coleraine, prospected on the Kerr Hill deposit, situated in block "B" of Coleraine township. *Messrs. Audet, Cyr and Lee* carried on work on lots 23 and 24, range I of Wolfestown.

It is also interesting to note that the *Universal Asbestos Co.* of Chicago, Illinois, erected a small mill at the Pennington mine, to work over some of the dumps, and recover some of the short fibre in a product which they designate as asbestos sand.

ASBESTOS DEPOSITS IN QUEBEC

In the Province of Quebec, there are six main centers of production of asbestos, and these localities in 1920 yielded nearly 180,000 tons of asbestos fibre, as compared with about 24,000 tons produced by all the other parts of the world, which include Rhodesia, Union of South Africa and United States. Of these six centers five are situated on the line of the Quebec Central Railway, which connects Quebec with Sherbrooke, a distance of 143 miles. These five centers are East Broughton, 60 miles practically due south to Quebec; Robertson, 71 miles; Thetford Mines, 76 miles; Black Lake, 80 miles; Coleraine, 86 miles. For that distance of 26 miles, between Coleraine and East Broughton, the railway follows the general trend of the serpentine belt, most of the principal mines being situated within a few hundred feet of the main line, and the asbestos deposits are therefore practically equidistant from Sherbrooke, and from Quebec. At Sherbrooke the railway connects with the railroad system of the United States and at Quebec is situated a harbour open to the largest ships during seven or eight months of the year.

The sixth center, is near Danville, eighty miles south-west (1) of Quebec, and thirty miles from Sherbrooke. The transportation facilities are therefore quite equal to those of the other producing centers.

Grading and testing of Canadian Asbestos.—Chrysotile-asbestos

(1) In report for 1920, page 24, owing to typographical error, this distance was given as south-east.

has the same chemical composition as the enclosing serpentine rock, and both have practically the same specific gravity. They are hydrated silicates of magnesia, and the difference between them lies in the physical form in which they present themselves. Serpentine is massive, whereas chrysotile, owing to the different arrangement of the molecules, is fibrous, and can be separated into slender, strong, flexible, silky threads. The separation of the asbestos from the enclosing rock is effected by hand-cobbing when the cross-fibre veins are of sufficient size to permit it, that is half an inch and over, or by mechanical treatment of the asbestos-bearing rock for the thin veins or for the disseminated fibre.

By the first method the so-called "crude" qualities are produced, of a length of fibre of half an inch and over. The second process constitutes the milling of asbestos rock, and produces the "Mill Stock qualities". As a rule the mill-stock grades contain only a small proportion of asbestos fibre measuring half an inch or over in length, and consist of mixtures ranging from half-inch fibre to one twentieth.

The basic principle of the separation of the asbestos from the serpentine is essentially to treat the ore, or asbestos-bearing rock, by crushing and pulverising machinery, which reduces the enclosing serpentine to powder and liberates the fibre, converting it into a light fluffy mass. The comminuted or pulverized rock is then eliminated by a series of screenings, the fluffy asbestos remaining on the screens and being picked up by a suction device, somewhat on the principle of the vacuum cleaner, which carries it upwards into settling chambers.

From the settling chambers the asbestos goes to the grading machines, where it is separated into grades according to length of fibre. These graders are circular trommels, usually made of perforated iron plates, the size of the perforations, or mesh, varying with the grade wanted. In the interior of the trommels, are arms, revolving in the opposite direction, to prevent the asbestos from blocking the holes of the trommels. The various grades thus separated, are then ready for the market.

The testing of asbestos, to check the grades and ascertain that their length of fibre corresponds to the specifications or requirements, is standardized. The test is conducted on a one pound sample of asbestos representing the average of a shipment. The testing apparatus consists of a nest of four rectangular trays, 24 inches long, 14 inches wide, and 5 inches deep, closely fitting on top of one another. The bottom of the upper tray, or No. 1, is a screen made of No. 12 S. W. G. wire, with openings $\frac{1}{2}$ inch clear; the second tray is a 4 mesh screen or 4 openings to the lineal inch, No. 16 wire; the third tray is a ten mesh or ten openings to the lineal inch, No. 18 wire; the last or lowest tray has a solid bottom. The nest of four screens is made fast to a frame, to which an excentric with a throw of $\frac{3}{4}''$, gives a movement of $1\frac{1}{2}$ inch travel.

The 16 ounce sample of asbestos to be tested representing the average of a shipment, is put on the upper tray which is covered. The machine is started at the rate of 300 hundred revolutions a minute of the shaft of the excentric, and this is kept going for exactly two minutes. At the end of this time, the asbestos which remains in each tray is weighed accurately and recorded, and this gives the number of the grade of the asbestos. For instance, grade 2, 9, 4, 1 means that of the 16 ounce sample, 2 ounces remained on the $\frac{1}{2}$ inch screen, 9 ounces on the $\frac{1}{4}$ inch, 4 ounces on the 1-10 inch screen and one ounce went through the latter into the bottom tray. Under normal conditions, the greater the proportion remaining in the upper trays the higher the grade.

The requirements of the manufacturer vary with the different uses he puts the asbestos to. It takes longer fibre to spin and weave than to make asbestos felt or to mix with cement to make asbestos tiles and shingles.

An asbestos broker of New York has adopted the following classification, of Thetford asbestos, which is one step towards standardization of the grades of asbestos.:—

Asbestos Crude No. 1, average length of fibre 1″
" " No. 2, " " " " $\frac{5}{8}''$
Long spinning fibre.....$1\frac{1}{2}$—$9\frac{1}{4}$—$4\frac{1}{4}$—1 down to
$\frac{3}{4}$—9 —$4\frac{1}{2}$—$1\frac{3}{4}$

Spinning fibre	¾	—5½	—6¾	—3	down to
	0	—8	—6	—2	
Magnesia covering fibre	0	—5	—8	—3	
Shingle stocks	0	—1¼	—10½	—4¼	down to
	0	— ½	—11	—4½	
Paper and Mill Board stocks	0	—0	—11	—5	to
	0	—0	—5	—11	

ASBESTOS IN OTHER COUNTRIES

United States.—Figures of production for 1920 are not yet available but it is estimated that Arizona, which is the chief source of asbestos in the United States, produced over 1,000 tons as compared with 420 tons in 1919. (1) The chief producer was the Arizona Asbestos Association, but operations were also carried on by the Regal mine, the American Ores and Asbestos Co., the Colorado Arizona Asbestic Mining Co., and the Alene Asbestos Association

South Rhodesia.—During the twelve months ending December 31st 1920, the production of asbestos of South Rhodesia amounted to 18,823 tons, or 21,082 short tons, valued at £459,572. During the previous year, 1919, the tonnage had been 9,799 long tons, or 10,965 short tons, the declared value of which, including adjustments for the previous year, was £425,240. Therefore for 1920 an increase of 92% in quantity was recorded, as compared with 1919. When it is remembered that in 1915, the Rhodesian production of asbestos was a little over 2,000 tons, the progress of the industry is striking.

The values for the two years, 1919 and 1920, are not comparable, for the former includes "adjustments on sales" for the period 1916 to 1919. Owing to the war, difficulty was experienced in obtaining the necessary information about actual sales in London, and adjustments were held over. This was dealt with in 1919, and the additional values reached approximately £200,000.

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(1) *Engineering and Mining Journal*, January 22nd, 1921.

To some extent, the occurrence of asbestos and chromite in Southern Rhodesia bears some close analogies to the Quebec occurrences of these minerals.

A large belt of intrusive basic rocks, which is designated by the descriptive term of "Great Dyke" extends across the greater part of Southern Rhodesia from north to south. It can be followed more or less continuously, for a distance of over three hundred miles. The width varies. In the Selukwe district, where are situated the most productive mines of chromite in the world "this intrusion is fairly uniformly some three to four miles wide, but varies from two and a half to rather more than four miles; it pursues a N.N.E.—S. S. W. direction, this direction and average width being fairly maintained north and south of the portion mapped." (1)

The predominent rocks of this Great Dyke are essentially of ultra basic types, rich in olivine, and Dr. F. P. Mennell says of it: "The great mass of coarsely crystalline picrite, extending for nearly the whole distance across Rhodesia, from north to south.... is.....predominently an enstatite rock....but there are more acid varieties, as well as others rich in olivine merging into almost pure olivine rock." (2)

Apart from the serpentine occurrences found in the Great Dyke, numerous outcrops of olivine rocks and serpentines are found in isolated intrusions throughout the country. The economic minerals associated with these olivine rocks, both in the Dyke and outside of it are asbestos, chromite, nickel, cobalt, magnesite, talc and diamonds.

The two main areas of serpentine which are worked for asbestos in South Rhodesia are outside of the great Dyke. One is the Mashaba field, near Victoria, and the other is the Shabanie field, near Belingwe. The geology of the South Rhodesian asbestos deposits has not been worked out in details. "Two quarries have

(1) A. E. Zeally. Report of Director, Geological Survey of Southern Rhodesia for 1911.

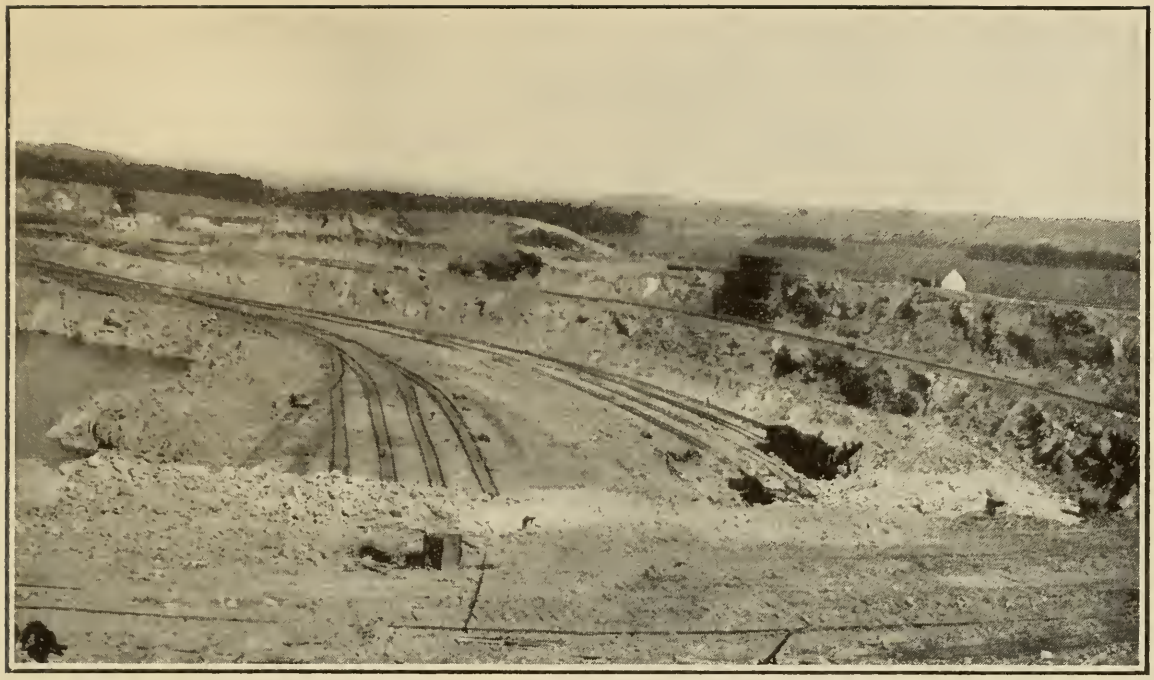
(2) Q. J. G. S., 1910, vol. LXVI.

"been opened in the Mashaba asbestos belt, and clearly expose the "mode of occurrence of the fibre..... The belt has an east and "west strike, and is some 200 yards broad. It is divided into zones "of pale green and greyish brown serpentine, which run parallel "with the length of the belt and dip due N. at 30°. The brown "zones being 3 to 6 feet wide are generally thicker than the green "ones, which measure one foot to 4 feet in breadth. All the asbestos "is contained in the green zones, the brown ones being barren. "Further, the best fibre occurs in the middle of the green zones, "that lying near the junction with the brown zones on either side "is generally hard and brittle. The veins vary from a small frac- "tion of an inch up to $1\frac{1}{4}$ inches in width. Bands of two or three "inches broad are occasionally seen. They consist of a number "of the ordinary bands lying side by side, for the fibre does not run "across the whole two or three inches, but is separated by thin "partings of gangue".

Milling of asbestos in Rhodesia is still in the early stages, but this is mainly due to the transportation question; the long haul to railway heads would not permit the shipment of comparatively low grade mill-stock.

The first asbestos area opened up was the Mashaba area, in 1908, which lies 26 miles west of Victoria, and at that time the nearest railway head was Selukwe, 65 miles distant by ox-team, from the mines. The deposits of asbestos are situated three or four miles south of the Selukwe—Victoria road. But, since then, a railway branch has been built from Gwelo to Victoria, and these quarries are now only 30 miles from railway head at Victoria. In the Mashaba field are situated the following mines, the King, the Gath, the Balmain, the Regina, the Clansman. The main operating companies in the Mashaba—Victoria district are: The King Asbestos Rhodesia Company, operating the King and the King "A" mines; the Rhodesian and General Asbestos Corporation, operating the Gath "A" and the Gath "B" mines; the South African Asbestos Co., operating the Balmain and the Balmain "A" mines.

Until the railway to Victoria was built, in 1914, the only means



Canadian Johns-Manville Co. Ltd., Asbestos, P. Q.—Method of development for steam-shovel loading and haulage by rail.

The J. V. Belanger Mining Company, ltd, Black Lake, Que.—Chromite concentrating mill.

of reaching Victoria was by the Selukwe—Victoria road, a drive by ox-team of some 90 miles, and haulage of asbestos from this field was only rendered possible by the fact that teams hauling supplies from Selukwe to Victoria, took back asbestos instead of returning to Selukwe empty. Under these conditions, it was not to be expected that the industry would greatly progress until the completion of the railway to Victoria.

The second area opened up is near Belingwe, at Shabanie. The Shabanie mines, as to transportation, are in the same position that the Mashaba field was before the railway.

Shabanie is 55 miles by road from Selukwe, the nearest railway point. But despite that fact, this field is forging ahead, and its production is higher than that of the Mashaba field, although the latter has a haul of only 30 miles instead of 55.

In the Shabanie district the main operators are "The Rhodesian and General Asbestos Corporation" operating the Shabanie 1 and Shabanie 2 mines; the South African Asbestos Company operating the Nil Desperandum mine; Willoughby's Consolidated Co., operating the Birthday "A" and the Birthday "B" mines. Under these conditions milling of asbestos is still undeveloped, for only the high grades, hand-cobbed, can stand the long haulage by ox-team. In the early stages of the industry, the veins were hand-cobbed and this material was beaten on flat iron sheets, to loosen the particles of rock, and this was screened by hand and separated into two grades. This method has been somewhat improved. The asbestos is still altogether hand-cobbed from the rock, but the beating, screening, and separating into two grades are done by machinery.

Union of South Africa.—Figures of production of asbestos for the Union of South Africa, for 1919, show a quantity of 3,932 gross tons, valued at £66,426. This is only a slight increase as compared with the previous year, 3,674 tons valued at £54,037. Of the figures for 1919, the largest part must be credited to the crocidolite or blue asbestos of the Cape province, which shipped

Fig. 1.—Sketch map showing asbestos deposits (as) in Rhodesia and Union of South Africa. –

3,203 tons valued at £57,578. The shipments of "amosite" in 1919 were disappointing, having been only 631 tons. Amosite is the new variety of asbestiform mineral, a silicate of iron, characterized by great length of fibre, found in the Lydenburg district in the Transvaal. However, the figures for 1920 will show a great increase in the production of this mineral, for the output of amosite for the first six months of that year is said to have reached 2,352 gross tons.

In the Union of South Africa (1) are found the four varieties of asbestiform minerals which present an economic interest, and all are being produced, or have been produced, in commercial quantities. These four varieties are: chrysotile, crocidolite, amosite, and tremolite. Crocidolite has a very characteristic lavender blue colour. It is also called Cape asbestos and Blue asbestos. In composition it is a silicate of iron and sodium. It is quite perceptibly heavier than chrysotile, having a specific gravity of $3\frac{1}{4}$, while chrysotile is $2\frac{1}{4}$. The rocks in which are found the deposits of this peculiar mineral have an extensive distribution. They occupy a wide belt, starting in Cape colony, thirty miles south of Prieska, on the Orange river, and extending in a northern direction for a distance of 240 miles, beyond Kuruman. The belt varies in width between five and twenty miles.

The crocidolite horizons consist of old sedimentary beds, highly metamorphosed, comprising siliceous, ferruginous slates, and ferruginous jasper rocks; they are designated under the general term of banded iron stones. They are compact, very fine-grained and hard, as may be surmised from their jaspery and quartzitic nature. The iron ore in the darker bands is found as fine grained magnetite.

The veins of crocidolite occur as interbedded cross-fibre seams. That is the veins conform to the direction of the bedding, and none are found disposed across the lines of stratification, as cross-fissures or cross-veins.

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(1) Most of the data on the asbestos deposits of the Union of South Africa are taken from the memoir on the subject by Mr. A. L. Hall, assistant director, Geological Survey of the Union.

The description of one of the main deposits now being worked near Koegas, in the most productive area of the blue asbestos fields, will convey a good idea of the mode of occurrence.

The asbestos-bearing rocks here consist of two zones, outcropping on the slope of a hill and entered by adits. The dip of the measures varies from 65° to 40° as one gets lower down the slope. The two reefs which are parallel, are separated by 60 feet of country rock. Each reef consists of a number of interbedded conformable, parallel seams of blue cross-fibre crocidolite. The number of seams of asbestos ranges from three to seven, spread out over 9 to 18 inches of rock. Individual seams persist for many yards. As to methods of working, adits are run as narrow as possible on the asbestos zones, some of these tunnels have attained a maximum length of 1,200 feet into the hills. From the floors of the adits, inclined shafts or winzes are sunk on the dip, to lower levels or drives. In this way the asbestos-carrying ground is laid out in regular blocks for stoping purposes.

The blocks measure 100 feet along the strike and 60 feet on the dip. They are handed to two boys (Kaffirs) who contract to stope out the slab of asbestos rock, 9 to 18″ thick. The stope is rarely more than 20 inches wide. It takes three months to stope out a slice of 6 feet on the dip, 100 feet long. It therefore takes three years to stope out a block. Thirty tons of rock is mined to obtain a ton of fibre. Very little timbering is necessary. This method of working is only adopted on the important deposits, but over the whole development of the banded ironstones from Prieska on the South, to Kuruman in the North there are numerous occurrences which are worked by trenching and narrow open-cut methods. At Koegas, where are situated the underground mines, the early workings were trenches all along the slope of the hill.

From the description of the workings, and of the deposits, it may be inferred that mining is attended by many difficulties. The narrowness of the asbestos bearing zones do not permit of adopting large scale mining methods, and for the past six or seven years the production has varied between 1,000 and 3,000 tons.

Amosite is a new variety of asbestiform mineral, found in a

definite horizon in the north-eastern part of Transvaal. It is more closely related to crocidolite, but it is distinguished from it (crocidolite) by the absence of sodium. It is a silicate of iron, with or without silicate of magnesium. It is characterized by the extreme length of the fibres, 5 to 8 inches being frequent, the greatest observed till now being eleven inches.

Although the discovery of Amosite dates back to 1907, this lay dormant until 1915, when development and exploitation of this mineral was begun. The origin of the name is from *Amosa*, an acrostic made up from the first letter of each of the words of Asbestos Mines of South Africa, a company which is now working several deposits of it, and has been quite active in the development of this industry.

The present fibre bearing area has been followed for a distance of 60 miles and has a width of six miles in places. It is situated in the north-eastern part of the Transvaal and the main activity is around Penge on the Olifants river, some thirty-five miles north of Lydenburg, the present rail-head.

The Amosite deposits are also interbedded cross-fibre veins, lying in the same banded ironstones beds as the crocidolite of the Cape Colony.

There are two principal mines now being worked, the *Egnep*, and the *Amosa*, $1\frac{1}{2}$ miles apart, and both in the vicinity of Penge, (Egnep is Penge spelt backwards). Of the two the Egnep is the more important producer, and a short account of the deposit of amosite here will give a general idea of its mode of occurrence.

The beds of banded ironstones are lying pretty flat, the dip is around 20°, and the amosite veins being interbedded with the strata, they are conformable with them.

The zone of asbestos bearing rock measures about 20 feet in thickness, and in this are nine seams, ranging from 7 or 8 inches down to $\frac{3}{4}''$. They show a combined length of fibre of 30 inches. The mineral lies as cross-fibre veins built up of tightly packed,

well oriented needles. These veins persist for several yards, or feet, according to the maximum width, and they taper down gradually, sometimes pinching out, and at other times continuing for some distance in a sort of thin film.

The main characteristic of the amosite is its length of fibre, which attains an observed maximum of 11 inches. Its mode of origin is essentially the same as that of crocidolite, and according to Dr. Hall "both are probably derived from ferruginous sediments "carrying some form of soda as an original constituent, not by "lateral secretion along open fissures, but by growth in situ, the "constant presence of magnesia being probably genetically con- "nected with the proximity to underlying beds of dolomitic rocks."

The figures of production of amosite since the exploitation began six years ago, show great fluctuations. It is possible that these wide variations are due to the abnormal conditions which prevailed during the war. The annual figures of production since the inception of the industry are as follows: 1915, 55½ tons; 1916, 407 tons; 1917, 3,192 tons; 1918, 936 tons and 1919, 729 tons. It is said that the 1920 production will show a considerable increase, and unofficial figures for the first half of the year give the output of amosite at 2,352 tons.

Chrysotile.—The most important deposits of chrysotile known in the Union of South Africa, are situated in the Transvaal, in the Carolina district. These occurrences are worked intermittently, but the production has always been very irregular, and no separate records of shipments from this field have been available for several years past. The occurrences differ from the Rhodesian ones inasmuch that this asbestos is found in serpentinized dolomite, (carbonate of magnesia and lime), and the deposits may be paralleled to those of Arizona, more particularly of the Grand Canyon. That is to say the dolomite is part of a thick series of very old metamorphosed sedimentary rocks.

The bed of serpentinized dolomite is from 6 to 50 feet thick, and is underlain by a thick sill of diabase, which is intrusive in it. In the lower part of this bed of dolomite, a zone of 18″ to 4 or 5

feet is asbestos-bearing, some of the veins being quite continuous over long distances, and attaining 3 inches or more; some have been found giving a fibre of 6 inches, but this is very exceptional, the majority of the recovered fibre being between $\frac{1}{2}$ and 1 inch.

All the work is underground, by adits and tunnels, driven for distances of 400 feet into the hill sides. As the zone of asbestiferous rock is narrow the underground workings are low, measuring 30 to 48 inches to avoid deadwork. The methods of preparation are simple, and consist of hand-picking, cobbing, screening in hand-worked rocking sieves. The qualities are divided into "Cobbings," which is straight fibre hand-picked and cobbed; and "screenings" which are saved from the screens in a more fluffy condition. These are bagged and hauled to Carolina station, 20 to 25 miles by road.

Although the quality of the Carolina asbestos is said to be excellent, it will never give rise to a large industry owing to the restricted extent of the deposits, which are not as extensive as the Arizona ones. As they are followed inward the seams of asbestos appear to pinch out altogether, and that is one of the reasons why the workings are not extended beyond 400 feet into the hill.

As may be surmised by the composition and the association of the Carolina asbestos the seams are derived from the alteration of dolomites, due to the serpentinization of magnesian silicates which resulted from thermal metamorphism, induced by basic intrusions into siliceous dolomite rocks.

It may be mentioned that chrysotile occurrences are found in Natal, and one of these has been worked in the Tugela valley in Zululand. In 1913 and in 1914 work was carried on this deposit and during the two years, 108 tons, valued at £2,126 were shipped. The asbestos was of inferior quality and was used in the manufacture of cement shingles and steam coverings. The mine, called Sitilo mine, is situated 25 miles from the railroad terminus at Krantzhop.

Tremolite deposits are worked in Natal, in Zululand, in the Dundee district. This is hauled to Dundee, where it is used in the manufacture of stove bricks, boiler lagging and steam packings.

Russia.—Before the war, Russia was easily next to Canada in importance of asbestos production, from the Ural mountain deposits, situated north-west of Ekaterinburg. The last yearly figures available are for 1913, when the output was 9,060 metric tons. Since then no reliable figures can be obtained. In this connection it is interesting to quote a statement of Mr. Fedor F. Foss, of the Russian Embassy, at Washington, published in the periodical "Asbestos."

"Production of asbestos in Russia was on the increase until "1913, when the export to foreign countries, mostly Germany and "England was available.

"In 1914, the export practically stopped and the mining "decreased, as asbestos was not a first-class essential for the war.

"In 1915, and 1916, the mines were running to half capacity, "and in 1917 came to a standstill when the revolution broke out. "As far as can be gathered from the publications issued in Soviet "Russia about the economic and industrial life, there are no signs "of revival of the industry."

In our yearly report "Mining Operations in the Province of Quebec for the year 1913", the following remarks appeared regarding Russian asbestos output:—"It is very difficult to get reliable figures of Russian asbestos production. The latest official figures, published by the Scientific Mining Committee," St. Petersburg, cover the years 1908 and 1909. For subsequent years, the data are obtained from unofficial sources and are subject to correction.

PRODUCTION OF RUSSIAN ASBESTOS

Year	*Metric Tons*	*Value*
1908	11,911	£ 175,452
1909	15,044	234,948
1910	10,847	
1919	15,182	
1912	11,000	
1913	9,060	

The average value of the Russian asbestos, derived from the above figures, appears to be between $70 and $80 a ton. This would indicate that only the higher grades (long fibre) of asbestos are shipped from the Russian mines, for as a rule the Ural asbestos is more brittle and less silky than the Canadian fibre, and commands a lower price for the same length of fibre. The Canadian asbestos is better suited for textile purposes.

It must be borne in mind that when the above remarks were written the average market prices of Canadian No. 1 and No. 2 crude asbestos, were in the vicinity of $275 and $130 a ton respectively.

COPPER AND SULPHUR ORE

The production of pyritous ores in 1920, was 15,186 tons representing a value of $98,854. This a decrease of 38,779 tons, or 71.8%, and of $348,769, in value, as compared with the preceding year, for which the figures were 53,965 tons valued at $447,623. The contents in metallic copper of the ore shipped in 1920 amounted to 1,125,825 pounds, as compared with 5,751,188 pounds, for the preceding year.

Several factors contributed to this poor showing. Pyrite has, to a very large extent, been supplanted by crude sulphur in the manufacture of sulphuric acid, and the demand for pyritous ores for this purpose, has been growing steadily less. This is due to the great development of the production of crude sulphur deposits in Louisiana and Texas. The output from these sulphur mines has been such that enormous stocks have accumulated, and the price of sulphur at the mines in 1920 has averaged $14 a ton, large quantities having been sold for as low as $10. The price of pyrite has had to be considerably lowered to meet these conditions, and in fact only the sulphuric acid plants favourably situated on the seacoast could afford to use Spanish pyrites, which sold for 12 to 13 cents a unit, Atlantic ports.

As our pyritous ores of the Eastern townships are copper-bearing, the fall in price of copper has also influenced the production.

Reports of shipments were received from three operators.

The Weedon Mining Company, operating on lot 22, range II of Weedon township worked without interruption throughout the whole year, but on a smaller scale than during the preceding year owing to the lack of market. The average monthly shipments were in the vicinity of 1,400 tons, or about one half of what they had been in 1919. The capacity of the hoisting plant may be judged from the fact that in 1917 and 1918 the records of the mine show some monthly shipments reaching 10,000 tons.

The main inclined shaft (No. 3) has not been sunk further than the 11th level, 965 feet on the dip of the deposit, or 708 feet vertically. From the 11th level, to the west of the shaft, a winze was sunk 205 feet to the 13th level. From the 13th level, in line with the axis of the shaft, another winze has been sunk 100 feet, to the 14th level, giving an extreme length, in depth, of 1,250 feet, on the dip of the deposit.

The Eastern Mining and Milling Company, operating the Huntingdon mine, at Eastman, shipped some concentrates, produced from their mill, but discontinued mining and milling in March, to turn their activities on the construction of a larger concentrator of a capacity of three hundred tons a day. The exploratory work carried on this property is said to have assured a large tonnage of 2 to $2\frac{1}{2}\%$ ore. The intention of the company is to eventually put up reduction works to produce electrolytic copper.

The Eustis Mining Company, did not reopen the Eustis mine, which has been closed down since March 1919. Their activities in 1920 were limited to the shipment of some lump ore from the stock piles.

CHROMITE

The production of chromite in 1920 amounted to 10,585 tons, valued at $247,730, a slight increase as compared with the previous year, when the figures were 8,184 tons valued at $223,331.

The greater part of the chromite produced in the province of

Quebec is in the form of concentrates running 50% and over of chrome sesquioxide, although a small quantity is also shipped in lumps, locally called crude ore, which is ore sufficiently rich to be shipped without requiring concentration.

Reports of production were received from four operators, as follows:—J. V. Bélanger Mining Co.; Bennett-Martin Asbestos and Chrome Mines, Ltd.; Black Lake Asbestos and Chrome Co.; and Mutual Chemical Company of Canada.

The change in the conditions of the chrome market in the United States, since the heavy demands for war purposes ceased in 1918, may be gauged by the fact that in the early part of that year the quotations for 45% chromite on the New York market reached $1.55 a unit, and that transactions were recorded at $100 a ton for 50% ore, whereas in February 1921, the quotation was 50c. a unit per long ton for minimum 50% f. o. b. Atlantic ports.

Under these conditions it cannot be expected that the Quebec chromite industry can develop to any extent, and, considering the irregular nature of the deposits, it is a matter of congratulation that it has been able to hold its own as well as it has, but its outlook for the future is not bright.

In 1920, the main sources of the world's supply of chromite were Rhodesia and New Caledonia. These countries, owing to the resumption of facilities of ocean freight traffic, resumed the importance which they had attained before the war as chromite producers. As an example, in 1920 Rhodesia exported 60,269 long tons of chromite, whereas in 1918 and 1919, it had exported 31,286 and 35,282 tons respectively.

The J. V. Bélanger Mining Company, Ltd., steadily operated the Bélanger mine, lot 19 S. E. range X, of Coleraine township. No further underground development work was done during the year, and there is at present a shaft some 80 feet deep, and about 300 feet of drifting and cross-cutting. These workings have been abandoned and all the ore is obtained from the open workings, consisting of two benches, from which 150 tons a day is mined.

The old mill was closed down early in May and for two months all work was concentrated on the erection and completion of the new mill, which was started running on July 3rd, and during the first month of operation it turned out 600 tons of concentrates. The mill capacity is 180 tons of ore per 24 hours; this is concentrated from an average content of 12% of sesquioxide, to 50% product, which is all supplied to the American Ferro-Alloys Company. The mill, is said to have cost over $200,000. The installation comprises two jaw crushers, a storage bin of large capacity; a 7 foot Hardinge Ball mill, two series of Callow double screens; two Allan cone classifiers, the overflow from the cones going to six Callow tanks. The sands are treated on ten Butchard tables. The middlings from these go through two Diester cone baffle classifiers and then over six Diester-Overstrom tables. In December they were putting in a Lowden continuous dryer, 24 by 6 feet, to thoroughly dry the concentrates before shipping.

The Mutual Chemical Company of Canada, Ltd., operated their property, on lot 19 N. W. range X, of Coleraine, throughout the whole year. All the ore is mined from the underground workings. The vertical shaft was sunk to a third level, at 300 feet, and with the sump has now reached the depth of 316 feet.

At the end of December 1920, the underground workings of the three levels of the Mutual Chemical Co's mine were as follows:

First level (100 feet),	length of drifts and cross-cuts	1323 ft.
Second level (200 feet),	" " " " " "	2693 ft.
Third level (300 feet),	" " " " " "	316 ft.
Depth of shaft	316 feet	
Raises	122 feet	

or in all 5,448 feet of underground workings.

The lens of chromite appears to be about 500 feet long, and varies in width from 8 to 60 feet. Most of the ore hoisted during the year comes from the second level. The ground is very blocky and fissured, and dangerous. The haulage ways have had to be timbered in many places and there are two gangs of scalers at work all the time. In open places the ore and rock slough down, or drop, continually.

The new concentrating mill was completed, and started operating in March 1920. Near the head frame of the shaft a crushing plant has been erected. From this point a belt conveyor, 360 feet long, carries the ore to the mill, where after a second crushing it falls into a large storage bin. It is then fed into two Hardinge mills, in series, and goes to two double Callow screens, in closed circuit with the second Hardinge mill. The fines go to a Simplex Dorr classifier. The slimes from the latter go to a settling tank, and the pulp to four Diester-Overstrom tables. The heads are treated on six Diester-Overstrom tables and the tailing from the tables go to two Wilfley tables, and a Dorr thickener. The concentrates go through a Duplex Dorr classifier and are dried.

The Black Lake Asbestos and Chrome Company, operated their chrome mine at Caribou Lake, on block "A" of Coleraine, whence most of the ore was shipped as crude, after a sorting underground. A small quantity was treated by a simple process of concentrating, as described in our report for 1919.

The Bennett-Martin Asbestos and Chrome Mines did not do any chrome mining during the year, but shipped a few tons of crude ore resulting from previous prospecting operations near their Vimy Ridge asbestos mine.

GOLD AND SILVER

The production of gold in 1920 was reported as 935 ounces valued at $19,346 and of silver 57,514 ounces, valued at $58,032. This a decrease as compared with the previous year, when the figures were 1,446 ounces of gold and 127,223 ounces of silver.

As for the past few years the production was all derived from the treatment of the copper ores of the Eastern townships and the zinc and lead ores of Montauban township, and from the decreased output of ores of these two mining districts during 1920, naturally follows the falling off in the figures of precious metals. From the Lake DeMontigny district, in the Abitibi region, the reports received at the Bureau of Mines show that only assessment work was

done on the various properties, some of which give good promise, as mentioned in our previous reports.

The property of the *Martin Gold Mining Company, Ltd.*, lots "A" and 37 ranges VIII and IX of the township of Dubuisson was sold by the sheriff in June 1920, and bought in by a syndicate of the creditors. An option was taken on this property by Messrs. Forbes and Dalton, of Timmins, Ont., and although no work was done in 1920, it is the intention to resume activities on this property as early as possible in 1921.

Report of work done on claims in the Lake DeMontigny region were received from the *Siscoe Mining Syndicate*, on Siscoe Island, partly in Dubuisson township and partly in Varsan; *Jas. J. O'Sullivan and al*, (Kienawisik Gold Mines, Ltd.), lots 48, 49, 50, 51, range IX, Dubuisson; *A. J. T. Wendt-Wriedt*, (Kienawisik Gold Mining Company), lots 59, 60, range VIII, Dubuisson; *Joseph F. Stabell*, lots 53, to 56, range VIII, Dubuisson.

MOLYBDENITE

No production of molybdenite has been recorded in the Province of Quebec during 1920. Reports of work done were received from two operators, viz:—*L. N. Benjamin*, and the *Daley Molybdenite Company*. The molybdenite deposit controlled by L. N. Benjamin is situated on lots 1 and 2, range I of La Corne township, in the Abitibi district, and this was described in detail in our report for 1919. During 1920 the work on this deposit consisted in further surface trenching. No work was done in the shaft.

The *Daley Molybdenite Company* proceeded with the development of a deposit on lots "G" and "J" range I, of Thorne township, 9 miles north-east of Shawville. Work was begun in 1919, when a shaft fifty feet deep was sunk, at the bottom of which crosscutting and drifting had been done for a length of 50 feet. The construction of a mill of a capacity of 25 tons of rock was begun in 1920. The concentrates will have to be hauled to Shawville by truck.

During the year 1920 there was practically no production of either molybdenite or tungsten in the whole of North America, owing to the stocks which had accumulated during the last year of the war, and the sudden cessation of the manufacture of war material. The molybdenum market was stagnant, price quotations being nominal, as there were no transactions of importance. These quotations varied between 65 and 80c. per pound of molybdenite containing 85%, but it is probable that to liquidate stocks some sales took place at much lower figures. Two years ago, at the end of 1918, molybdenite was quoted over $2 a pound on New York market.

The molybdenum situation has been summarized in a recent review as follows:—* "The future of molybdenum is in the steel in- "dustry, and producers can hope for no change until the merits of "molybdenum steel are sufficiently recognized by users of alloy "steel. As soon as the miners can convince the consumer of the "merits of molybdenum, mines will resume operations.

"During 1920 Professor Arnold, of Sheffield, experimented "with a high speed tool-steel containing about 5% molybdenum, "and presented a paper on this subject that created world wide "discussion. This steel has not been favourably received in the "United States, although reports from England seemed to indicate "that it met approval there.

"Steel metallurgists in the United States are working with "fractional percentages of molybdenum in producing steel in which "the average content of molybdenum is about one third of one "per cent and results are surprising. The applications of this "steel are now well established in the automotive industry and "are continually branching out into other uses, notably for rail- "way springs. In the mining industry, reports are noted that "molybdenum has commercial advantages in steel balls, for grind- "ing mills and rockdrill steels, and further investigation in this "field may provide an output."

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* W. Norman Bratton, in Engineering and Mining Journal, January 22nd, 1921.—

The metallurgy of molybdenum and of its use in alloys for the manufacture of special steels has made great progress in the last few years. Molybdenum steels have properties analogous to tungsten steels, and the proportion of the metal added to obtain the same effects of toughness and hardness, which are retained at high temperatures almost up to red heat, is from three to five times less than for tungsten. This property of retaining its temper at high temperatures is invaluable for the manufacture of high-speed tool steel. However, there are greater precautions to be taken in the manufacture of molybdenum steel, one of the principal difficulties being the tendency of molybdenum to volatilize at the high temperatures necessary in the working and hardening of the high molybdenum steels. (*)

In a pamphlet entitled *Molybdenum Commercial Steels*, issued by the Climax Molybdenum Company, very interesting data on the manufacture of molybdenum steels and results of tests have been given, which are briefly summarized in the following:—

Comparison of Molybdenum and Tungsten tool steels. (**)

No. 1. Steel:—Molybdenum 5.79%, Vanadium 1.29, pounds of steel removed 111.90.

No. 2. Steel:—Tungsten, 15.93, Vanadium 1.16, pounds of steel removed 109.80.

Chrome—Molybdenum Steel

Carbon	0.15 to 0.40%
Manganese	0.40 to 0.80%
Chromium	0.70 to 1.10%
Silicon	0.10 to 0.20
Molybdenum	0.25 to 0.40

used for automobile truck and tractor, forgings, shafts, crank shafts, connecting rods, steering knuckles, propeller shafts, etc. Tensile strength 145,000 to 170,000.

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* John A. Matthews—A. I. M. E. Bulletin, February 1921.—

** Investigations by Prof. J. O. Arnold and F. Ibbotson.—

Chrome—Molybdenum Steel

Carbon	0.40 to 0.50
Manganese	0.60 to 0.90
Chromium	0.80 to 1.10
Silicon	0.10 to 0.20
Molybdenum	0.25 to 0.40

used for springs in the automobile industry. Tensile strength 200,000 to 230,000.

Chrome—Nickel—Molybdenum Steel *

Carbon	0.25 to 0.35%
Manganese	0.50 to 0.80
Silicon	0.10 to 0.25
Chromium	0.70 to 1.00
Nickel	2.75 to 3.25
Molybdenum	0.30 to 0.50

Steel for airplane crank shafts, connecting rods, propeller shafts, clash gears and other parts where quality is of paramount importance. Steel used in the Liberty motor crank shafts and rods. Tensile strength 150,000 to 265,000.

Nickel—Molybdenum Steel (**)

Carbon	0.20 to 0.40
Manganese	0.25 to 0.50
Nickel	3.00 to 5.00
Silicon	0.10 to 0.20
Molybdenum	0.30 to 0.70

used in pinions, axles, crank cases, brake drums, axle housings, gears. Tensile strength 173,000 to 176,000.

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* United Alloy Steel Corporation, Canton, O.

** Carbon Steel Co. Pittsburgh, Pa.—

Chrome—Vanadium—Molybdenum Steel (*)

Carbon	0.30 to 0.40%
Manganese	0.40 to 0.60
Chromium	0.70 to 1.00
Vanadium	trace to 0.85

used for crank shafts, gears and springs. Tensile strength 105,000 to 245,000.

Molybdenum, in the form of ferro-alloy may be introduced into the steel by any of the customary methods. Recent developments have shown that molybdenum may also be introduced into steel in the form of calcium molybdate, with equal efficiency. This statement is based on the results of many commercial tests in open-hearth and electric furnaces made at both government and private plants.

The molybdenum steels, containing carbon from 0.15 to 0.40%, develop, under suitable heat treatment, a sufficient variation in physical properties to meet all the demands of motor car construction, from case-hardened to oil-hardened parts, and parts requiring properties intermediate thereto.

Also the more special steels, such as spring steel, valve steel, ball bearing steel, are developed through the use of molydbenum.

ZINC AND LEAD

As all other metals, zinc and lead felt keenly the adverse economic conditions accompanying the readjustment period. The production for 1920 shows a marked decrease as compared with the previous year, that is 3,015 tons of concentrates valued at $56,-925, instead of 5,318 tons valued at $103,138.

The production for 1920 comes from the Montauban district and is divided up into 1867 tons of zinc concentrates, containing 1,493,600 pounds of metallic zinc; 100 tons converted into zinc

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* Crucible Steel Co. of America., Pittsburgh, Pa.—

oxide, and 1,048 tons of galena, from which 1,006,080 pounds of metallic lead was recovered. The lead concentrate, moreover, contained a certain proportion of precious metals.

During the year 1920, work on lead and zinc deposits in the province was limited to two localities, viz:—Notre-Dame des Anges, in the county of Portneuf, and the township of Lemieux, at the head waters of the Cascapedia river, in the county of Gaspé.

At Notre-Dame des Anges, the *Zinc Company, Limited,* carried on work during practically the whole year. Although hoisting was discontinued for several months, exploratory work was proceeded with during that time, by means of diamond drilling. Several holes, varying from 130 feet to 600 feet were put down, in all directions. During the mining operations the monthly hoisting of ore was in the vicinity of 5,000 tons a month.

The shaft has not been sunk further than the 3rd level, at a depth of 254 feet, on an average inclination of 60°. The first 125 feet of the shaft is inclined 58° but the lower part is somewhat steeper. On the third level, to the north of the shaft, a winze was sunk 100 feet, to the fourth level, where a drift of some 250 feet has been driven.

Owing to the unsatisfactory state of the zinc market, this company has further developed the manufacture of zinc oxide, by doubling the capacity of the zinc oxide plant, situated near the station of Notre Dame des Anges.

The *Federal Zinc and Lead Company, Ltd.*, who has for several years been developing the promising deposits of lead and zinc ores of the region of the head-waters of the Cascapedia river, carried on some mining work during the year 1920, but the main effort of the company bore on the construction of the road, from the mine to the railway, a distance of 45 miles.

The mining development work which they carried on was, in the main: deepening the No. 1 shaft, vertical, a further 105 feet, reaching a depth of 257 feet. Cross-cutting on the 250 foot level,

to an amount of 150 feet. Driving an adit 104 feet into the hill, near the McKinley vein, towards the main workings of the No. 1 shaft.

The geology, and the deposits, as then developed, were described at length in the report on Mining Operations in the Province of Quebec for 1917, from the field work and investigations made by Mr. Mailhiot, professor of geology at Polytechnic School, Montreal.

That the zinc and lead industry in general suffered during the year 1920 may be gathered from the fact that for January the average market price of metallic zinc in St. Louis was 9.133 cents, while for December it had fallen to 5.824, having reached a minimum of 5 $\frac{3}{4}$ cents in November. During the first four months of 1921, the situation did not improve to any extent and for some weeks the quotations were under 5 cents, or much below the possible cost of production under the present conditions of cost of labour and of coal.

MAGNESITE

The shipments of magnesite from the Grenville district in 1920, amounted to 17,941 tons, valued at $512,755. Of this quantity 10,491 tons was clinkered or dead-burned; 3,154 tons was calcined and 4,296 tons was shipped in the crude state.

The figures show a marked increase, as compared with 1919, when the production was 9,940 tons valued at $283,719, which represented 6,696 tons of clinkered magnesite, 1,656 of calcined, and 1,588 tons of raw magnesite.

Reports of production were received from three producers, viz: The Scottish-Canadian Magnesite Co. Ltd., lot 15, range XI, township of Grenville; The North American Magnesite Co. Ltd., lot 15, range IX, Grenville, and The International Magnesite Co. Ltd., lot 13, range I, township of Harrington.

The *Scottish-Canadian Magnesite Co. Ltd.*, during the first part of the year shipped clinkered magnesite from stocks which had

accumulated from their operation in the Hull cement plant, and in the meanwhile they were erecting a complete sintering plant near their quarry, in Grenville township, and improving the methods of quarrying. The new sintering plant was put in operation in July 1920, and has given very good satisfaction. A short description of the plant, as it was being erected in 1919, was given in our report of Mining Operations during 1919. Briefly, the magnesite as it comes from the quarry, is broken to one inch size in a large gyratory crusher. The right proportion of iron ore is mixed with the rock at the gyratory crusher. The iron ore is magnetite which comes from the Ironside mines, on the Gatineau river. The iron ore added is always 3% Fe_2O_3, and a strict chemical control is kept on this phase of the process, the weight of the ore added varying with the composition, so as to keep the proportion of iron oxide constant. From the crusher the magnesite, mixed with the iron ore, is elevated to two Krupp ball-mills, for a coarse reduction, and the grinding is then finished in tube mills where the mixture is powdered to 100 mesh. It passes to the rotary kilns, 60 feet long each, fired with powdered coal. There are three kilns, two of which are worked simultaneously, while the third is a spare. The capacity of each kiln is 30 tons of dead-burned magnesite for 24 hours. On coming out of the kilns, the sintered magnesite is conveyed to a "cooler", by a McCauslin elevating conveyor. After cooling it is passed through coarse crushing rolls, the product being separated into (1) coarse sinter, $\frac{1}{4}$ inch and over, (2) fine sinter, which goes through the $\frac{1}{4}$ inch screen.

The *North American Magnesite Company, Ltd.*, carried on their sintering operations at the plant of the Canada Cement Company, at Longue Pointe, using their raw product from their Calumet quarry. The raw magnesite was shipped partly by the narrow gauge railway of the Dominion Timber and Minerals, Limited, to the C. P. R. station at the junction point of Magnesite and partly hauled by teams to the station at Calumet. During 1920 a sintering plant was erected at Calumet, near the railway station. The buildings housing the machinery are very substantial, being built of cement blocks. The machinery consists of a large gyratory crusher, installed at the top of the hill, and a jaw crusher to take the oversize. The rock is then stored in a large concrete bin. A

ball mill does the preliminary pulverizing to 20 mesh, and a pebble-mill reduces this to 100 mesh powder, which is then sintered in a 100 foot rotary kiln, fired by an aero-pulverizer. The sinter is conveyed to a cooler, which is a long revolving cylinder, of steel plates, and from the cooler the dead-burned magnesite goes to an automatic bagging machine. It was expected that the mill would be completed and ready to produce early in the summer of 1920 but unexpected delays in the delivery of machinery postponed the starting of operations until very late in the year. As a consequence the company continued to sinter magnesite at Longue Pointe until the end of October.

The plant at Calumet is for a production of 40 tons of dead-burned magnesite per day.

The *International Magnesite Company, Ltd.*, produced steadily from their quarry, on N ½ lot 13, range I of Harrington, or the Dobbie mine, both raw magnesite and calcined magnesite. The raw magnesite is shipped to steel works, and the calcined is shipped to the United States for the manufacture of flooring cements. The shipping of the production of the Dobbie mine is effected by the narrow gauge railroad, to Magnesite station.

The magnesite deposits of the Province of Quebec which are at the present worked, are situated in the townships of Grenville and Harrington, in the county of Argenteuil, on the north shore of the Ottawa river, about half way between the cities of Montreal and Ottawa. They were opened up in 1907, for the purpose of supplying material to manufacturers of flooring cements, and for the production of carbonic acid gas for aerated waters. At the time it was not possible to compete with the Austrian magnesite for refractory material purposes, as this latter product was firmly established with the metallurgists. Moreover the Grenville magnesite possesses the disadvantage to be high in lime and it does not contain sufficient iron oxide to bond the dead-burned product. Therefore the production of Quebec magnesite remained a small industry until the cutting off of the Austrian product, by the war conditions, drew the attention of users of refractory materials to the Argenteuil deposits.

At first a strong prejudice existed against the Quebec magnesite, owing to its high contents in lime. But after experimentation, a dead-burned magnesite is now manufactured from it, which gives full satisfaction and has been declared by users, to be equal to the Austrian dead-burned magnesite.

By strict chemical control all the lime is converted into silicates of lime and iron, which are neutral compounds, which increase the power of resistance to corrosive agents and an addition of finely powdered iron ore, intimately mixed before sintering, supplies the bonding qualities. There is no free-lime now in dead-burned Quebec magnesite, which was the objectionable feature in the early stages of the manufacture.

However, investigations were carried on by the Federal mines branch, on the possibilities of reducing the lime contents, and the following notes give the results of laboratory experiments made with this object in view.

"The magnesite quarried in Grenville township, Quebec, "contains too high a percentage of lime to be classed as high grade "material for certain uses to which magnesite is put. In some "cases the lime is said to be decidedly detrimental, while in others, "it may be considered simply as an impurity, lessening the available "percentage of magnesia in the rock. An investigation was con- "ducted to devise if possible, some method whereby the lime "content could be reduced, or eliminated.

"Small blocks of magnesite were heated in an electric furnace "to about 1000°C., and the temperatures at which the constituent "minerals yielded up their carbon-dioxide, were observed. These "temperatures of dissociation indicated that the magnesite rock is "composed essentially of the minerals magnesite and dolomite. It "contains but small quantities of subsidiary minerals. The mag- "nesite and dolomite have very similar optical properties and cannot "readily be differentiated in the uncalcined rock, both being white, "or nearly so. On calcination, however, the magnesite darkens "to a pink, yellow or green and shows in strong contrast to the "calcined dolomite which is pure white.

"The specimen was broken up and the two constituents care-
"fully separated and analysed by Mr. M. F. Connor.

	A (white)	B (pink)
"Lime (CaO)	54.82 per cent	1.85 per cent
"Magnesia (MgO)	44.42 " "	96.90 " "
"Ferric oxide (Fe_2O_3)	0.07 " "	0.13 " "
"Manganic oxide (MnO_2)	0.05 " "	0.08 " "
"Alumina (Al_2O_3)	0.06 " "	0.01 " "
"Insoluble mineral matter	0.60 " "	0.86 " "

"By scanning these analyses, it will be seen that A, the white "constituent, approaches calcined dolomite in composition, the "excess magnesia probably being due to imperfect separation. "The pink constituent, B, contains less than two per cent lime, "due, doubtless, to fine particles of dolomite which were not separated "from it.

"Owing to the physical similarity of magnesite and dolomite, "no method suggested itself for separating them in the uncalcined "state. It was found, however, that in the calcined rock the "properties of the minerals were very different and offered means "of attaining the desired result.

"On treating the calcined rock with water it slaked; the pink "constituent breaking down to a coarse, gritty powder, the grains "of which averaged from one to three millimetres in diameter, "while the white constituent slaked into smooth paste which went "into a milk when agitated with water. By draining off this milk, "the bulk of the dolomite was removed, leaving magnesia in a "fairly pure state. The dolomite lime was saved by allowing it to "settle out of suspension.

"By means of small and simple laboratory apparatus, the lime "content of a sample of calcined magnesite was reduced from 16.5 "to 3.66 per cent. The washings analysed 48.49 per cent lime "and 45.50 per cent magnesia—true dolomite lime gives 58.2 and "41.8, respectively. The foregoing is based on the results of first "experiments. There is little doubt that the lime can be reduced "considerably below the figure quoted.

"The investigation was not completed at the end of the year, "but the tests conducted indicated the feasibility of producing "caustic magnesia, low in lime, from the high-lime magnesites, and "at the same time obtaining, as a by-product, dolomite lime paste "suitable for structural purposes or for utilization in the manufacture "of sulphite pulp." (*).

Following up this line of investigation, experiments on a larger scale are now being proceeded with in the ore-testing plant of the Federal Mines Branch at Ottawa.

GRAPHITE

The production of graphite in 1920, according to the returns received from the operators of mines and mills, totalled 466,420 pounds, valued at $31,913. During the preceding year the Quebec graphite industry had been practically at a standstill, the only returns of shipments received being for experimental purposes, on which a nominal value of $400 had been put.

Two operators reported shipments, the *Quebec Graphite Company*, operating on lots 1 to 4, range IV of Buckingham township, and the *Consolidated Graphite Company*, operating the Peerless mill on lot 14, range X of Buckingham township.

Moreover, reports of work done on properties, but no shipments made, were received from the *Laurentian Graphite Company Ltd.*, who took over the property of Graphite Limited, lots 15 and 16, range VI of Amherst township, and from the *North Quebec Mining Development Company Ltd.* who did some prospecting on lots 11 and 12, ranges V and VI of Amherst, the main showing being situated on lot 12, range VI.—

The *Quebec Graphite Company Ltd.*, Buckingham, after a prolonged shut down of the mine and mill began alterations in the mill towards the end of 1919, to install the Callow process of flota-

* Summary report Mines Branch, Department of Mines, Ottawa, 1916, page 21.

tion. Milling was resumed in May 1920, and the process proved suitable to the ore, effecting a satisfactory separation. At the time the mill was visited by an officer of the Quebec Mines Branch 30 tons of ore a day was being treated. As remodelled the flow sheet of the mill is as follows:—The ore is crushed to 2″ size and from the crusher it goes to a Hardinge ball mill, where it is reduced to about 20 mesh. This is screened, the oversize of the 20 mesh size goes back to the mill; the 20 to 24 goes to tables and the through 24 goes to rougher cells, the tailing from the roughers going to the dump. The concentrate from the rougher goes to a 60 mesh screen. The +60 material goes to two sand tables and the —60 goes to tube-mill. The concentrate from all the tables goes to the filter, and the tailing goes to tube-mill. All the tube-mill products go to two cleaner cells, the tailing from the first cleaner going to roughers and from the second cleaner to tube-mill. The concentrate from the cleaner goes over an 80 mesh screen. The+80 material goes to sand tables. The concentrate from sand table goes to filter. The tailing from the tables go to the tube-mill. The—80 from screen goes over slime tables. The concentrate goes to filter and the tailing to tube-mill. From filter the graphite goes to the dryer, and is screened into+80 and—80. It then goes to the polisher. When going through the polisher the+80 material, besides the large No. 1 flakes, gives fines, which constitute Nos. 2 and 3, recovered from the screens of the polisher. The—80 after polishing is No. 3 graphite.

The very fines (—150) before polishing pass through an air-float chamber, in a current of air induced by a fan, and according to their lightness these fines are carried to a greater or less distance and they settle in four different receptacles, giving four grades, used for foundry facings and paints.

The Company has gone into the manufacture of finished products, and they are now putting on the market lubricants and pastes. They intend to eventually extend this to electrodes, greases, stove polish.

The *Consolidated Graphite Company Ltd.*, resumed operations under the management of Mr. H. P. H. Brumell, and ran for about

ten weeks during the spring. A substantial quantity of graphite was produced and shipped.

From the technical, or mechanical, stand point, the graphite industry appeared to have been successful in 1920, the oil flotation concentration as applied to the two mills operated having given satisfactory results. But owing to the very depressed state of the graphite market, prices obtaining in 1920 were probably below cost of production. The Buckingham flake graphite brought prices varying from 9 cents a pound for No. 1 coarse flakes down to 3 cents for No. 3, with corresponding lower for fines.

The situation of the graphite industry during 1920 was adequately described by Professor B. L. Miller, as follows * :—Again the graphite producers of the world report a disastrous year. Indeed, there was greater depression during 1920 than in 1919. Although graphite is used in a large number of articles, the greater portion of the production has gone into the manufacture of graphite crucibles, for which only the best grades are suitable. Graphite from Ceylon has long held the field."

"When the armistice was signed, the principal manufacturers of graphite crucibles had on hand large quantities of high-priced graphite, and the producers likewise had large supplies ready for shipment. The demand for crucibles diminished, and there still remain available large amounts of graphite produced under war conditions. The inevitable result was a fall in the market prices to a point below the cost of production. At present there remain unsold thousands of tons of Ceylon, Madagascar, and domestic graphite, and until this accumulated surplus has been absorbed there is little chance of general revival of the industry." *

MICA

During the year 1920 the shipments of mica from Quebec mines totalled 1,496,399 pounds, valued at $281,729.

Mica statistics are very unsatisfactory, for the price of this

* Engineering and Mining Journal, January 22nd, 1921.

substance varies from $4 or even $5 a pound for large size sheets used for special purposes, down to scrap mica valued at $10 and less per ton. Moreover mica is put on the market in different forms, or stages of preparation, rough-culled mica, thumb trimmed mica, thin split mica, scrap mica, being the principal ones. Operators are not always careful to indicate these classes of mica or to differentiate them in the returns to the department, hence the difficulty of making comparisons from year to year.

The production of mica during 1920 may be divided as follows, as to the forms in which it was marketed:—rough-culled mica, 317,209 pounds, valued at $34,583; thumb-trimmed mica 513,382 pounds, valued $157,499; thin splittings 123,570 pounds, valued at $87,536, the balance being scrap mica at a little over $8 a ton.

Prices were satisfactory throughout the whole year. Small sizes were rather higher than the previous year, and large size remained the same. The following are the prices per pound which obtained in 1920:—

1 x 1 inches	10 to 17c	2 x 4 inches	70 to 90c.
1 x 2 "	18 to 23c	3 x 5 "	$1.20 to 2.00
1 x 3 "	30 to 35c	4 x 6 "	2.00 to 2.50
2 x 3 "	45 to 60c	5 x 8 "	2.50 to 3.00

According to the report of the Federal Department of Mines, the total production of mica for Canada in 1920, was $368,267. The Quebec production therefore represents 77% of the whole of the Canadian production.

In the Province of Quebec mica is mined in the district immediately north of the Ottawa river, in the basins of the Gatineau and Lièvre rivers. The mica produced is amber mica, or phlogopite, which for the construction of electrical machinery, is superior to muscovite, or white mica, on account of its elasticity, cleavage and dielectric properties.

* "The mica deposits of the province of Quebec are found in con-

* "Mica, Occurrence, exploitation and uses",—Report of Mines Branch, Dept of Mines, Ottawa.

nection with masses of pyroxenite rocks, which occur in the Pre-Cambrian rocks, gneisses, paragneisses, crystalline limestones, so well developed in the district in question. The pyroxenites are coarsely crystalline, and composed mainly of pyroxene and feldspar. In these pyroxenite masses the mica is found in three types of deposits. (1) True fissure deposits, (2) pocket deposits and (3) contact deposits, the most common of which is the pocket deposit type. The erratic course and irregular distribution of the leads and pockets are a source of much confusion, and the sudden pinching out of an apparently extensive and promising pocket of mineral is a frequent occurrence and characteristic of such deposits. The pockety nature of mica deposits must always prove a serious obstacle to their successful exploitation. There are few rules and indications, as in the case of ore bodies, by which the miners may be guided, they having to depend largely on chance in following the mica leads.

The mining of mica is at present almost entirely of a superficial nature, and might, in most instances, more properly be termed quarrying. Where, however, deposits have been followed by means of shafts and drifts, to depths of a hundred feet and over results have shown that the mica is by no means confined to the surface."

The last remark is well illustrated by the case of the Blackburn mine, situated on lot 9, range XI of the township of Templeton, which has been worked underground for some time, and which was one of the important producers in 1920. This mine, which is situated some three miles north of Perkins Post-Office, is entered by a slope or inclined shaft, of 60° which is now 260 feet deep, with a sump at the bottom. The first level is at 60 feet. Drifting has been done to the right, for a distance of 300 feet, and stoping of the deposit has been done almost to the surface, to which the stope is open.

The second level, at 110 feet has been drifted to 200 feet to the right, and the deposit had been stoped out to the first level. Not very far from the shaft a cross-cut driven at right angles to the drift has struck a parallel lens of mica at a distance of 30 feet.

The third level is at 160 feet. Drifting has been done to the right for 300 feet. Some stoping has been done, and a raise has been broken through to the second level.

The fourth level is at 210 feet, and has been drifted to the right for 250 feet. Partly stoped out and in one place has been broken through to the third level.

The fifth level is at 260 feet. At that depth the mica zone is somewhat narrower, and the mica is more checked. A drift has been started to the right, and was in a distance of 60 feet or so in July 1920. As soon as they have advanced sufficiently, a raise will be put in to open through to the fourth level.

The mica from this mine is all hauled to Ottawa by team, a distance of some thirty miles, to the trimming and splitting shops.

FELDSPAR

The production of feldspar in 1920 amounted to 849 tons valued at $11,252, as compared with 924 tons valued at $11,665, in 1919.—

Mr. Bush Winning continued to produced high grade dental spar from the deposit of the West ½ of lots 2 and 3, range IX of the township of Portland East.—In summer, this spar is hauled to the Lièvre river by which stream it is transported to Buckingham.—During the year the lack of a landing place on the river greatly interfered with the shipments.—In winter the spar is hauled by team to Buckingham, a distance of some 25 miles.—This dental spar is shipped to Philadelphia, to Newark, N. J. and to France, for the manufacture of artificial teeth. — Messrs. Watts and Noble, of Kirk's Ferry worked a feldspar quarry on lot 14c range II of the township of Templeton.—The greater part of this feldspar is used in the manufacture of scouring soaps and powders.—

A new deposit of great promise was opened by Messrs O'Brien and Fowler, of Ottawa, on the South ½ of lot 7, range 7, range 1 of the township of Derry, about 3 miles N. E. of Glen Almond.—A

small quantity was shipped, but the work dore in 1920 sonsisted mainly in development and the erection of a plant which will enable to ship large quantities in 1921.—This feldspar is used for ceramic manufacture.—

SILICA

During the year 24,865 tons of rock was extracted from quartz and silica quarries. This is a considerable increase over the previous year when the shipments amounted to 15,055 tons only. But it exceeds that of the year 1918 by 1,579 tons only. The value of the production in 1920 is $60,147, an increase of $9,986, or 19 per cent over the previous year.

These figures represent the shipments of Arthur Sicard, St. Canut; Georges Pedenaud, Buckingham; the Cascades Silica Products Company, St. Canut; the Consolidated Sand & Supply Company, Melocheville, and of the Temple Silica Sand Company Ltd., East Templeton.

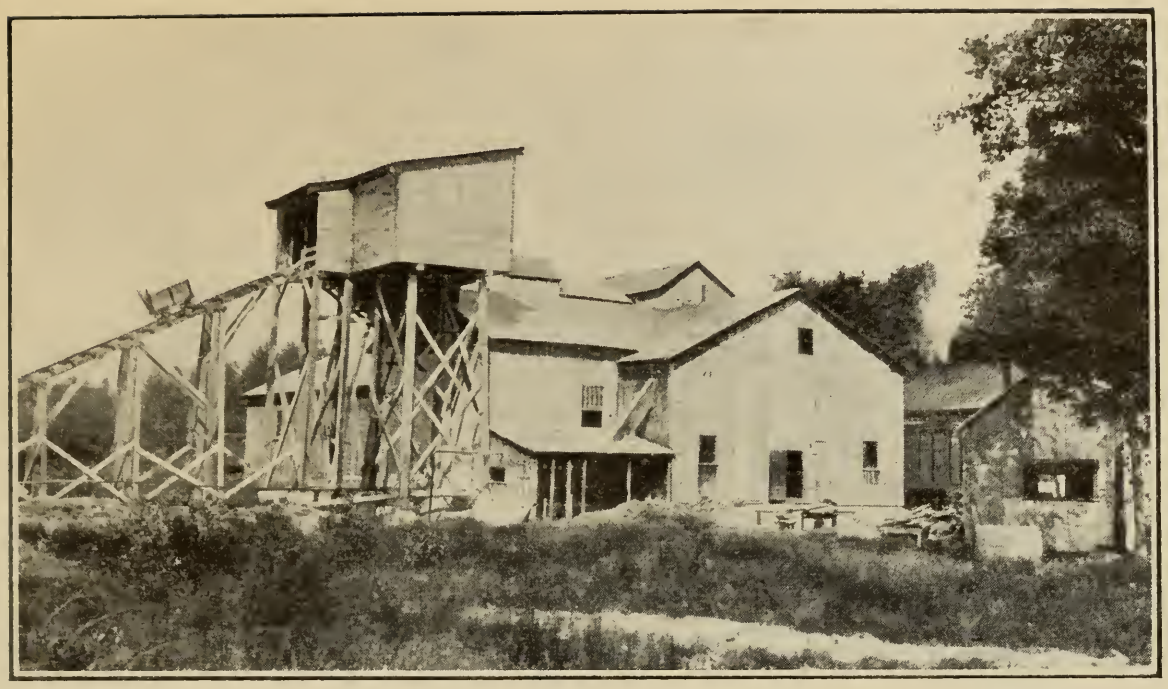
This silica came almost entirely from the Potsdam sandstone; a small quantity was extracted from quartz veins in the Laurentian rocks of the township of Buckingham. This silica, is used as raw product in various industries, either in pieces, or crushed as sand. Two companies have crushing mills, namely: the Consolidated Sand & Supply Company, in Melocheville, at the foot of the Beauharnois canal, and the Cascades Silica Products Company, at St. Canut, county of Two Mountains. The latter company operates a quarry, in a massif of sandstone forming a plateau some thirty feet above the level of the surrounding plain. It extends on lots 125 to 130 of the parish of St. Canut, over a length of half a mile. Its shape is irregular and its width varies between 300 and 2,000 feet. In the eastern part, the plateau forms an escarpment from 28 to 30 feet in height. It slopes gently towards the west and disappears beneath the cover of earth on lot 124. The surface of the plateau is flat, and partly denuded of trees. It is formed entirely of strata of Potsdam silicious sandstone. It is calculated that the part of the plateau above the level of the plain contains 3,300,000 tons of sandstone. Borings have proved that the Pots-

dam sandstone occurs in depth at this point; Laurentian gneisses having been struck only at a depth of 429 feet. However, all the beds that have been cut do not contain the same high percentage of silica. At a depth of about 200 feet, there is a bed rich in grains of feldspar of the size of a small pea. The sandstone of the St. Canut plateau is very high in silica. The average of twenty-two samples taken from different places of the plateau, gave 99.18 per cent of silica.

About the month of October, 1919, Mr. Arthur Sicard began operations on lot 125. His quarry is connected with the main line of the Canadian National Railway by a narrow-gauge road.

In 1918, Mr. Kennedy Stinson began operations on lot 130. He erected a crushing plant and built a standard-gauge railway spur 3,000 feet long to the main line of the C. N. R. About the close of that year he sold this property which was acquired by Mr. Aurélien Boyer. At the same time, the latter also acquired the rights on lots 126, 127 and 129. The Cascades Silica Products Company in which Mr. Aurélien Boyer has the chief interests, transferred its Pointe Cascades mill to St. Canut at the end of the year 1919, and, in the spring of 1920 it began quarrying on lot 129.

The washing plant is on lot 127. The stone is conveyed in a mine-car from the quarry to the head of the mill, where it is crushed to an inch and a half size in a jaw-crusher, and afterwards falls into a Chili-mill consisting of a pan and rollers. These two rollers, twenty inches in diameter, with shells of manganese steel, four and a half inches wide, revolve around a vertical axis. The pan is nine feet in diameter; its bottom is lined with manganese steel. On each side of the grinding pan are two trommels six feet in diameter and two and a half feet wide covered with a screen of alloy-steel. All that passes through the screen is sent to the sand washers. There are two sets of such washers, each of which has five troughs twelve and a half feet long and a foot and three-quarters wide inclined 20° In each trough is a screw conveyor The sand falls into the lower part of the first trough while a jet of water comes in at the top. The revolving screw raises the sand



Cascades Silica Products, Ltd.—Crushing and washing plant.

Cascades Silica Products, Ltd.—Silica sandstone quarry. St Canut, P. Q.

while the stream of water washes it and clears it of mud. It passes successively through the five troughs where the same operation is repeated. The muddy water is taken outside of the building.

On reaching the head of the fifth and last box, the sand falls on a belt eighteen inches wide which conveys it to the top of the draining room. After draining the sand is dried in a rectangular apparatus made of brick which is 20 feet long, seven feet wide and four feet high, resting on a concrete foundation. Inside are seven rows of pipes. The five upper rows have fourteen pipes two inches in diameter, with regular spaces between them. The two lower rows consist of eighteen $1\frac{1}{2}$ inch pipes. The sand passes slowly from the hopper above the dryer, through the spaces. Steam circulates in the pipes. The sand is gathered in a hopper beneath the dryer and a conveyor belt, followed by a bucket elevator, conveys the sand to the storage bins.

Quartz, quartzites and silicious sandstones are used for a great many purposes. As a source of silica they are used for making glass and for ceramics, in the preparation of ferro-silicon and carborundum and in metallurgy as a flux. On account of their high refractory properties, they are used for making crucibles, moulds for casting iron and steel, bricks and refractory linings and also kitchen and laboratory utensils. Owing to their resistance to wear they are used for making hones, oilstones and whetstones; grindstones to separate the fibres of pulp wood and to grind mineral substances; also pebbles and linings for pulverizing apparatus. They are also used as abrasives, and for cleaning and polishing. Among the many uses of lesser importance may be mentioned: cleaning with a sand blast, sprinkling roofing paper, floor sweeping compounds, filters for drinking water, priming paints for wood work, scouring soaps, polishing powders and sand paper.

For making glass it is necessary to have sand very high in silica and with a degree of purity varying according to the quality of the glass to be made. Iron is the greatest deleterious impurity of glass sand. For optical glass and the higher grades of cut-glass not more than 0.02 per cent of sesquioxide of iron is tolerated.

For certain cut-glasses, a proportion of 0.05 is allowed; for mirrors 0.1; for plate-glass, 0.2. For glazing or for prescription bottles, sand with less than one half of one per cent of sesqioxide of iron is not rejected. A greater proportion of iron is tolerated for making green and brown bottles. The only effect of the alumina, lime and magnesia is to reduce the percentage of silica.

Ferro-silicon is prepared by reducing silica in an electric furnace. As a rule, sand containing more than 98 per cent of silica is specified. For that purpose hard and compact quartzite or siliceous sandstone in pieces weighing from ten to twenty-five pounds, is used. The presence of iron is allowed, but lime and alumina are not desirable, while phosphorus, arsenic and sulphur are deleterious elements.

Carborundum is a carbide of silicon prepared by synthesis in an electric furnace; it is a very hard product, used as an abrasive. The sand used in making it must contain over 99 per cent of silica.

The sand used in the ceramic industry must contain less than one half of one per cent of iron oxide, and be pulverized very fine. Quartz forms a part of the body of the ware and also serves for glazing enamel and porcelain.

Silica bricks are indispensable in the manufacture of steel. They alone can withstand the high degree of heat in steel furnaces. When used for making bricks, the analysis of the silica must approach the following averages: alumina 1.5 per cent; oxide of iron 1.0; magnesia and alkalis 0.5; silica 97 per cent. Experiments have shown the possibility of making good bricks with the St. Remi d'Amherst quartzites.

The utensils made of fused sand are very transparent; thermometer stems and tubes for ultra violet rays are also made of it. Fused silica possesses very great power of resistance against sudden changes of temperature, wear, acids, and is insoluble in water, It is also an ideal and permanent electric insulator. In the United States, glass fused in an electric furnace is used for making laboratory utensils and apparatus for acid reactions in chemical industries.

The properties of sand required in foundries vary with the use made of it. Practice differs so much in the different establishments and the substance used varies to such an extent that it is almost impossible to standardize moulding sand. As a rule foundry sand must contain a proportion of at least 95 per cent of silica; the grains must pass through a 20 mesh screen and remain on a 200 mesh screen.

Silica is used as an abrasive, in the shape of dust, whetstones and mill-stones. An extremely fine powder is made of it for polishing pearl and bone buttons; for making scouring-soaps, cleaning powders, pastes for polishing metals, sand-paper; sand-belts, for bleaching wood, are prepared with silica pulverized fine. Hone, oilstones and whetstones are cut out of the rock or are made with very fine grains of silica compressed into a cement. In the trade are also found stones for rubbing and sharpening tools, for grinding flour, ochres, mordants and mineral substances and also for separating the fibres of pulp wood. In painting, pulverized quartz is used as a filler for dressing wood and spreading paints, and it is found that such paints stand weathering much better. Sand used as a filtering medium in filter plants must be clean, free from clay, dust or organic matter. The grains may be either round or angular. The best are those whose diameter varies between 0.25 and 0.35 millimetres.

Roofing-paper makers use, every year, a considerable quantity of sandstone crushed very fine for dusting the paper freshly coated with tar; sand that can pass through a 65 mesh screen, white in colour and free from dust is required.

There are still many other uses for sand; it will suffice to mention, making matches and dry-sweeping compounds for floors; the friction sand dropped on the rails before the wheels of tramways and locomotives.

MARL

In the course of the year a company was organized for the purpose of exploiting a deposit of marl earth at Millette lake, on

lot 24 of range VII of Wentworth township, Argenteuil county. The *Canadian Whiting Company Ltd.*, did some preliminary work. The company intends to work this deposit by means of a modern mechanical method and to install dryers and the other machines required for preparing whiting for the market, from this marl.

Marl is a more or less pure carbonate of lime found in the shape of earthy matter at the bottom of bogs, in layers interstratified with beds of peat or again at the bottom of certain shallow lakes. The following description of the manner in which it is formed will be found in the "Geology of Canada" of 1863:

"It appears to be formed by the waters of springs highly charged with lime, which is at first held in solution as bicarbonate, but is deposited when these waters come to the air. It is thus similar in its origin to the deposits of calcareous tufa, which occur in many places where such calcareous springs flow over earth, rocks, and vegetation, instead of falling into lakes or marshes. The presence of carbonate of lime is a necessary condition of the development of shells, and various species of mollusca in such waters. These by their remains, which often form a considerable portion of the deposits, give to such the name of shell-marl, which is frequently applied. The substance is white, and earthy in its aspect, and, unless mixed with clay, is a nearly pure carbonate of lime; which, from its finely divided state, is well adapted to serve as a dressing for such soils as are deficient in calcareous matter."

In some places the farmers use it for white-washing their houses. It may be made into good fat lime by calcination. But its chief use is for improving acid soil for which is is preferred to limestone dust owing to its fineness which allows the earth to better absorb it. In the United States the 98,000 tons produced in 1918, were used entirely for that purpose.

Deposits of fresh-water marl are scattered pretty much over the whole settled portions of the Province of Quebec. The following localities may be mentioned among others: Island of Anticosti; Bristol township, lot 11, range X; Cox township, lot 15, range IV; Hamilton township, lots 11, 13, 14, range IX; Harrington

township lot 5, range IV; Masham township, west of the Gatineau river; Matane township, lots 17 and 18, range V; Neigette township, at de la Peinture lake; township of Stanstead, lots 4 and 5 of ranges X and XI; Wakefield township, lots 14, range I; Wentworth township, lot 24, range VII and lot 22, range VIII; Argenteuil seigniory, lot 3, range I; Vaudreuil seigniory, anse à Cavagnol; St. Hyacinthe seigniory, at the foot of Mount Yamaska on the Granby road to St. Pie; St. Armand, lots 157 to 158.

NICKEL AND ALUMINIUM

Both the nickel and the aluminium industries of the Province of Quebec are essentially metallurgical ones. The province does not produce ores of nickel or of aluminium, but as the reduction of such ores and the refining of the metals require large units of electric power, at the lowest possible cost, it is natural that the Province of Quebec, with its wealth of water-powers, should become the seat of such industries, treating imported nickel-matte and bauxites.

Nickel.—The British-America Nickel Corporation, Ltd. began the erection of large nickel refining works in 1917, at Deschênes, on the Ottawa river, three miles above the city of Hull, the large amount of power necessary for this refinery being obtained from the Chaudière Falls, on the Ottawa river at Hull.

The British-America Nickel Corporation was incorporated by Dominion charter issued July 2nd 1913, with an authorized capital of $20,000,000 for the purpose of acquiring nickel properties in the Sudbury district and of erecting a smelter and refining works. The project was under way when war was declared in August 1914, and it lay more or less in abeyance until 1915, when the company secured the cooperation of the Imperial Government, in the form of advances in money and a long term contract for an annual supply of nickel from its Canadian works. The mines and the smelter of the company are situated near Sudbury, whence all the matte from the smelter is shipped to the Deschênes refinery.

The refinery uses the Hybinette process, which is an electro-

lytic process, requiring a large amount of electric power. The matte treated, as it comes from the smelter, contains about 80% of copper and nickel, the balance being sulphur. In this process, the matte, which is recovered from the smelter in a granulated form, is roasted to remove the bulk of the sulphur. It is then leached with a 10% sulphuric acid solution, whereby a large proportion of the copper, with very little nickel, is dissolved out. The residue from the leaching contains 65% nickel, 3 to 8% sulphur, the remainder being copper with a trace of iron. This is melted down and cast into anodes.

The plants for depositing the nickel and copper are quite independent. The electrolyte used for the nickel, is a dilute solution of sulphate of nickel, with a small proportion of weak acid, carrying 45 grammes of nickel and 3 to 5 milligrammes of copper per litre, and is supplied by rubber tubes to the cathode diaphragms. The first step consists in placing in the electrolytic solution an anode plate, composed as above, approximately, of three parts nickel to one copper with some sulphur, and a cathode plate, upon which the metal is to be deposited, and in separating the electrodes by a pervious diaphragm such as filter cloth. This is done by enclosing one of the electrodes in a bag of such cloth. This bag is only a convenient mechanical device for directing the circulation of the liquid in a direction from cathode to anode.

After circulation the electrolyte contains from 2 to 3 grammes of copper per litre, and is passed over waste anodes, which deposit the copper and resupply nickel to the solution. The action of the anodes resembles that of pig iron in the cementation of ordinary copper, except that the copper is deposited by nickel instead of by iron. The amount of waste anode obtained during the electrodeposition of the nickel, (about 30 to 40% per cent of the original weight) is said to be about sufficient for the purpose of rejuvenating the exhausted solutions from the nickel vats, and it is stated that the solutions never require to be thrown away, as the cementation purifies them sufficiently.

The cathodes for the nickel department are contained in special canvas bags obtained from Glasgow, and stated to last about 18 months.

The nickel cathodes are made of iron plates rubbed over with a thin wash of water and graphite. The nickel is deposited on both sides of the plate, so that each plate yields two sheets of nickel. The nickel deposition takes about 10 days to complete. The deposited nickel weighs from 20 to 30 pounds per sheet. After being washed in weak sulphuric acid to remove basic salts, the sheets are dried and cut up into oblongs 2 inches by 3. The metal is guaranteed 99% of nickel, but can be made purer. The precious metals become concentrated in the anode slime, which is melted up into fresh anodes, and electrolyzed separately, the final slime being sold direct for its precious metal contents.

The recovery of the copper is effected very similarly to that of the nickel, but on copper sheets, and without enclosing one of the electrodes in a bag. The copper takes about seven days for the deposition. The precious metals are obtained as in the case of nickel. (1)

The Deschênes refinery of the British America Nickel Corporation, has a capacity of 15,000,000 pounds of nickel per annum, and at a comparatively small expense can be increased to 20 or 24 million pounds. The matte from the smelter passes through two wedge roasters, each with 8 hearths, and thence to the leaching department, where the copper in part is dissolved with sulphuric acid, and plated out in the electrolytic copper tanks, the cathodes being melted down and cast into 81 pounds ingots: about 55 tons of copper being produced per 100 tons of nickel.

The leached matte, with fluxes, is then smelted, in especially designed electric furnaces using 24 inch circular carbon electrodes, and cast into nickel-copper anodes, weighing 200 pounds. These anodes then go to the nickel depositing building, which covers three acres, and not only is the nickel plated out, but a large amount of nickel-sulphate and nickel-ammonium salts is being produced for the nickel-plating industries.

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(1) Data on the Hybinette process have been given in the "Report on the Ontario Nickel Commission", Bureau of Mines, Ontario, and in "The Nickel Industry" by Dr. Coleman, Department of Mines, Ottawa.—

The slimes remaining after the nickel anodes are dissolved, are collected and concentrated, and will be refined in the precious metals department to yield metals of the platinum group, and gold and silver.

The site for the refinery was decided upon on account of the cheap power developed at the Chaudière Falls of the Ottawa river. In the power sub-station of the refinery is a very fine electric installation, supplied by the Canadian Westinghouse Co., comprising transformers, five rotary converters of 4,000 ampères each, three with a range of 70 to 290 volts on the D. C. side. There is also a reserve 1,000 K. W. generator, driven by a steam turbine, there being two 1,000 H. P. Babcock and Wilcox boilers equipped with superheaters, economizers and forced draft.

The three plants of the British-America Nickel Corporation, that is to say the mine and the smelter near Sudbury, and the refinery near Hull, were completed and began producing early in the year 1920, and at the end of the year, they had demonstrated that they will achieve a high degree of efficiency in working costs, in the tonnage of ore they will handle, and in the very pure refined metals produced. Unfortunately owing to the unprecedented bad market for all metals, the company has decided to cease operations for the time being, but will resume as soon as the demand for, and prices of the metals become normal.

Aluminium.—The Northern Aluminium Company, a subsidiary of the Aluminium Company of America, has important reduction works at Shawinigan Falls, where they reduce bauxite to aluminium metal. The choice of the location of the works was directed by the electric power available at Shawinigan, the reduction of bauxite to aluminium requiring a large amount, about one horse-power-year for each 500 lb. of the metal, according to European practice. The works of the Northern Aluminium Co. of Canada have an annual capacity of 15,000 tons of metal per year (1).

The Shawinigan Falls works manufacture aluminium ingots,

(1) The Mineral Industry, during 1919, Vol. XXVIII, p. 11.

and alloys for casting purposes. They also have a rod and wire mill. Moreover, at Toronto, the Northern Aluminium Co have established a plant for the manufacture of aluminium sheets, stampings, castings and fabricated articles.

The ore of aluminium is bauxite, a hydrated oxide of aluminium, of which no deposits have yet been discovered in Canada. The United States are the world's main producers of this substance the output for 1919 having been 376,566 tons, extractedfrom deposits situated in Georgia, Alabama, and Tennessee. During the previous year, 1918, the output had been 615,413 tons.

The imports of alumina (bauxite dried and treated for the removal of impurities) into Canada during the calendar year 1920, amounted to 57,414 gross tons.

BUILDING MATERIALS

The resumption of activity in building operations during the year 1920 has had its effect on the quarries. Compilation of the figures received from the operators, shows a value of production of $11,054,857, being an an increase of $2,964,616, or 37 per cent over the previous year.

Quarry products constitute a considerable proportion of the mineral production of the Province of Quebec. For this year, like the last one, the value of building materials represents 39 per cent of the total production, pottery being the only item which shows a decrease.

High prices have contributed to a fairly large extent to the increase in total value, but this is also due to greater activity in quarry operations. Thus, with brick, the increase in quantity is 38 per cent; it is nearly twice the increase in value, which in only 20 per cent. The increase in the quantity of calcined lime is calculated at 50 per cent and in value 31 per cent. It is otherwise with cement, the increase in the price of which greatly exceeds that in quantity; this is attributed to the very high cost of coal. There is reason to foresee that demand for building materials will con-

tinue. The revival of building operations after the period of stagnation caused by the war, is developing and it has not yet attained the maximum of the year 1913. There is a dearth of dwellings in all centres. The high cost of rents, the drop in the price of materials and of labour will hasten the period of intensive construction necessary to reestablish the balance between supply and demand.

Below will be found a table taken from the *Labour Gazette*, published by the Department of Labour, which appeared on page 244 of its issue of February 1921. It shows the variation of the estimated cost of building operations from 1910 to 1920 as indicated by the building permits given in five cities of the Province of Quebec.

The table on page 75 shows that, to reach a degree of activity equal to that of 1913, taking the difference in prices into accounts, it will be necessary to attain a production at least double that of 1920. This table gives only the value of the cost of building operations in the five following cities: Montreal, Quebec, Sherbrooke, Trois-Rivières and Westmount. It is a good index of the variation of activity in that industry.

These figures merely show the movement of building operations in the five largest cities of the Province. To ascertain their real value, recourse must be had to the yearly "Municipal Statistics" published by the Department of the Provincial Secretary. It is estimated at $23,433,285 for the year 1919, say a little more than one and a half the total of $15,166,851 for the above mentioned cities.

The Province of Quebec is particularly favoured as regards building materials. It possesses many deposits of building stone, desirably situated throughout the Province.

From the beds of Trenton limestone on which a part of the plain of the valley of the St. Lawrence rests, dimension stones have been obtained with which a number of edifices and residences have been built in the cities.

ESTIMATED COST OF CONSTRUCTION FROM 1910 TO 1920 IN FIVE CITIES OF THE PROVINCE OF QUEBEC

YEAR	Montreal	Quebec	Sherbrooke	Three-Rivers	Westmount	Total
1910	$ 16,742,019	$ 526,498	$ 555,000	$ 218,400	$ 1,961,985	$ 20,003,902
1911	22,516,832	795,254	920,004	133,008	1,340,092	25,795,190
1912	22,433,398	933,002	1,100,004	372,800	1,833,093	26,672,297
1913	29,723,452	1,939,781	747,540	482,450	2,000,316	34,895,449
1914	20,022,640	2,759,572	191,322	652,130	698,163	24,527,591
1915	8,263,021	2,576,342	354,876	484,205	589,405	12,267,849
1916	5,529,544	2,912,157	368,830	537,345	544,754	9,890,630
1917	5,501,918	2,459,386	254,000	423,860	154,985	8,794,149
1918	4,882,873	904,375	150,920	638,975	275,211	6,852,354
1919	10,033,901	2,134,219	873,150	1,242,450	883,131	15,166,851
1920	14,067,609	2,301,480	3,265,538	845,975	1,179,890	21,660,492

The area over which beds of limestones are found form a large triangle, the summits of which are: Hull, Quebec and lake Missisquoi. Among the principal operating centres should be mentioned the group of the Island of Montreal, Rosemount, Villeray, Mile End, Papineau, Poupart, Delorimier, Longue-Pointe, Pointe-aux-Trembles, and Bordeaux; and those of Ile Jesus, St. Martin, Cap St. Martin, St. Vincent de Paul and St. François de Sales. There are others at Hull; Joliette; St. Marc des Carrières; at Beauport and Château Richer, near Quebec; at St. Dominique, near St. Hyacinthe and others of less importance in many other places. There are also quarries in patches of limestone beds of this or other formations, in Dudswell township, at Lake St. John, in the bassin of lake Matapedia and at Chandler.

Besides the cutting of dimension stones, the limestone quarries furnish broken stone for road metal. At St. Marc des Carrières and Lime Ridge, stone is ground and sold to farmers to improve their land. At Lime Ridge, small stones are sized for poultry grit.

From Stanbridge very pure limestone is shipped to Shawinigan for making carbide of calcium. A certain quantity of limestone, in blocks containing a high percentage of lime, is sold to the paper mills who use it in the tower system of sulphite liquor. This is a limestone containing 97 per cent of carbonate of lime which is now preferred to a magnesian limestone.

The construction of important buildings in the large centres has contributed to the development of granite quarries. There are in the Province large occurrences from which stones with pleasing colours can be obtained. Fine gray granite is shipped from Stanstead and Megantic in the Eastern Townships: Argenteuil supplies a pink large-grained granite for monuments; in the township of Campbell, near Mont-Laurier, a quarry has been opened on a very pleasing pale red fine-grained granite; the piers of the Quebec bridge are built of heavy blocks from the quarries at Rivière-à-Pierre, county of Portneuf; at Roberval, Lake St. John, a mass of coarse grained granite, with large crystals of a red feldspar, is being quarried. Near Iberville, on the northern and southern slopes of Mount Johnson, fine stones of a syenitic rock, known

as "black granite" on the market, are being extracted. The grains of this rock are of medium size and it is of a dark colour. It is much used for monuments.

Last year the Province produced marble to the value of nearly a quarter of a million dollars; this marble comes exclusively from the metamorphic rocks of Missisquoi. Slabs are taken from them of a rich mottled gray, with opaque white, or greenish-gray bands; others have large pink clouds irregularly distributed over a deep green ground. The walls of the halls of several large buildings in the commercial quarter of Montreal are covered with Missisquoi marble. The effect is rich and pleasing to the eye. The Province also has other deposits not yet exploited. Those of South Stukely may especially be mentioned. The value of this marble is chiefly due to its rich tints. The slabs from it, after being polished, reveal a fine-grained marble delicately veined, banded and spotted with pretty shades of pale yellow; in others, the colour varies between light pink and chocolate pink with veinlets of white calcite. The yellow, pink, green, bluish-gray, and chocolate tints match together with the most attractive effects according to the beds from which the slabs are taken.

During last summer, Mr. Rupert Simpson carried on preliminary work in the zone of red marble in the seigniory of St. Joseph de Beauce in the valley of Colway creek, a tributary of the Chaudiere river. It is a hard, fine-grained stone, brick-red in colour with specks and veinlets of white calcite. It is very suitable for ornamentation.

Production was very active in the lime-kilns of the Province. Besides the demand for building purposes, the chemical industries consume an ever increasing proportion of lime. It is needed for making glass and lighting gas, in sugar refineries, in the preparation of wood pulp by the sulfite process, in tanning, in the ceramic industry, in purifying drinking water, in making caustic soda and chloride of lime, etc.

During the past year, a new kiln was lighted at Dufaultville, in the township of Cabot, county of Matane. It is a stone kiln fired with wood, the property of Mr. Etienne Levesque. He

opened two quarries, which he had later to abandon, in a band of impure limestone belonging to the Levis formation. In the middle of the season, he burned limestone from Val Brillant on the west shore of lake Matapedia. Mr. J. H. Giroux built a battery of two kilns in the Ste. Marguerite range of St. Louis de France, county of Champlain, at a distance of seven and a half miles from Trois-Rivières and four miles and a half from St. Maurice, the nearest railway station. These kilns are cylinders 12½ feet in diameter of sheet steel with a refractory lining a foot and a half thick. Coal is use for fuel. The kilns have been in operation since the month of January 1920.

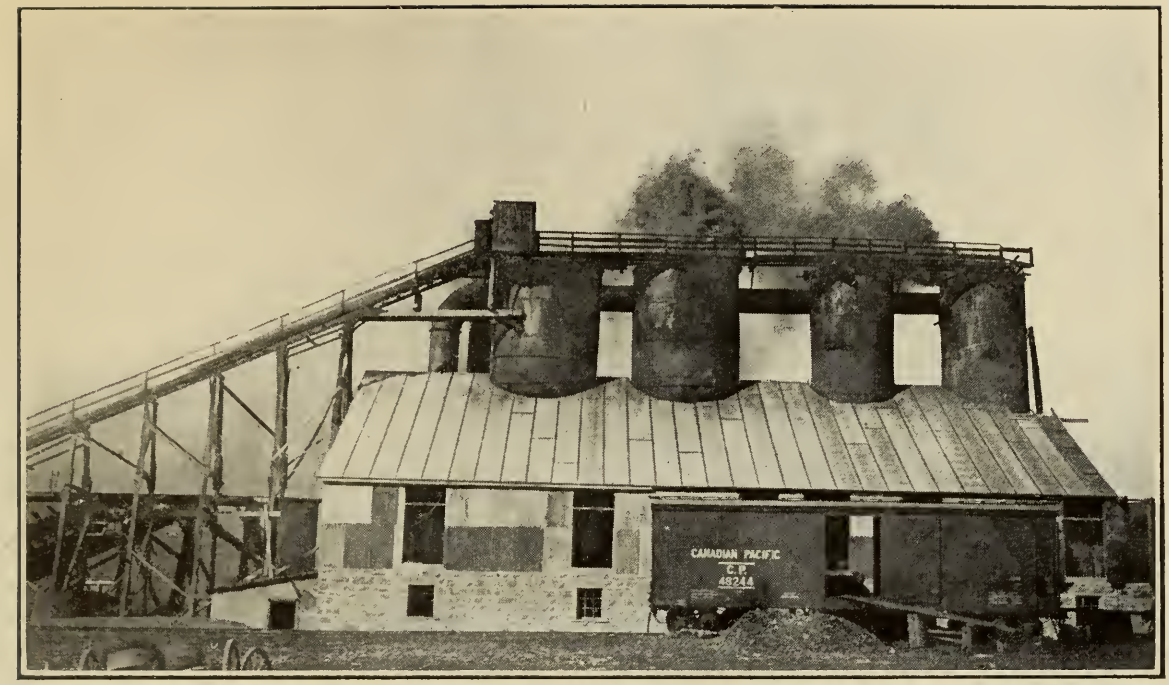
Operations in the slate quarries of Melbourne township, of Richmond, were continued. The New-Rockland Slate Company, Ltd. opened another quarry on lot 24 of range IX on which there are bands of green and purplish-coloured slates. Slate is always preferred for roofing in high-class buildings on account of its physical qualities, its resistance to breaking and the stability of its colour. The slate of the Province of Quebec is especially sought for in the Province of Ontario where it finds a considerable market.

During the preliminary work on a band of marble in the seigniory of St. Joseph de Beauce, a deposit of red slate was found. The British Canadian Marble Company Ltd. has put up a crushing mill with a view to exploiting it. There is at present a market for crushed slate which is used for making patent shingles with a slate surface.

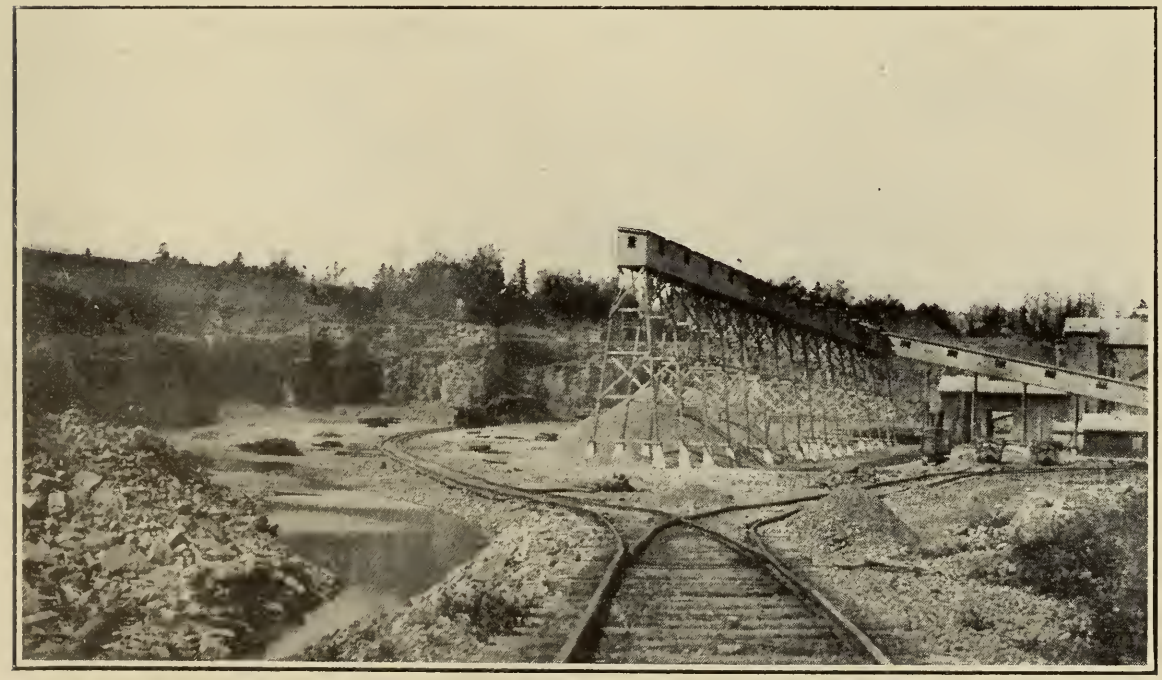
The sandstone produced during the past year comes from the quarries of St. Romuald, county of Levis. The green sandstones of Sillery are quarried the stone being used for road-making.

The Canada Cement Company continued its operations in its quarry and large mill at Pointe-aux-Trembles. The Hull mill was put in operation again in the month of April after six years interruption.

The brick-kilns of the Province produced nearly two million dollars worth of bricks during the past year. This is the greatest



Standard Lime Co. Ltd.—St-Marc-des-Carrières, P. Q.—Lime Kilms.



Carriere de Quebec, Ltee,—Beauport, P. Q. Road metal plant.

yearly production recorded so far. It exceeds in value that of 1913 by 50 per cent. Nevertheless, the number of thousands of bricks made is 36 per cent lower than that of the year 1911, when the brick-yards gave their greatest yield.

The most important producing centres are Delson and Laprairie, near Montreal; Stadacona and Boischatel, near Quebec; Ascot and Lennoxville, near Sherbrooke. St. Jean Deschaillons has dropped to a lower rank as a producing centre. About 1913, that place had as many as 23 brick-yards employing 350 men. The brick was in great demand and large quantities were shipped to Montreal in barges. At present there are only two brick yards.—

LIST OF THE PRINCIPAL OPERATORS AND OWNERS OF MINES AND QUARRIES IN THE PROVINCE OF QUEBEC

ASBESTOS

Asbestos Corporation of Canada Limited,
J. McCallum, Secretary, Thetford Mines, Que.

Asbestos Mines Limited,
East Broughton, Que.

Beaudoin, P. E.
Thetford Mines, Que.

Bell Asbestos Mines,
Hon. Geo. R. Smith, Vice-Pres. and Mgr., Thetford Mines, Que.

Bennett-Martin Asbestos and Chrome Mines, Limited,
Thetford Mines, Que.

Black Lake Asbestos and Chrome Co, Limited,
Black Lake, Que.

Canada Asbestos and Chrome Co, Ltd,
Coleraine, Que.

Canadian Johns-Manville Co, Limited,
Asbestos, Que.

Consolidated Asbestos, Limited,
Norman R. Fisher, Mgr., Thetford Mines, Que.

Federal Asbestos Company,
Robertsonville, Que.

The Frontenac Asbestos Mining Co.,
F. W. Ross, 92 St. Peter Street, Quebec City.

General Asbestos Co., Limited,
East Broughton, Que.

W. Jacobsen,
Black Lake, Que.

Johnson's Co.,
A. S. Johnson, Mgr., Thetford Mines, Que.

Maple Leaf Asbestos Corporation,
Thetford Mines, Que.

The Pennington Asbestos Co.,
Thetford Mines, Quebec.

Quebec Asbestos Corporation,
E. E. Spafford, Mgr, East Broughton, Que.

Windsor Asbestos Company Limited,
Coleraine, Que.

CHROME

J. V. Bélanger Mining Co, Ltd.,
Black Lake, Que.

Black Lake Asbestos & Chrome Co, Limited,
Black Lake, Que.

C. L. Campbell,
602 Royal Trust Bldg., Montreal.

Dominion Mines & Quarries Limited,
Canada Life Building, Toronto, Ont.

J. D. Kennedy,
Sherbrrooke, Que.

Mutual Chemical Company of Canada ,Limited,
Black Lake, Que.

Quebec Asbestos & Chrome Co.,
Douglas B. Sterrett, Manager, St. Cyr, Richmond Co., Que.

Victory Chrome Mines, Ltd.,
103 St. François Xavier, Montreal.

COPPER

Eastern Mining & Milling Co., Limited,
Bk. of Hamilton Bldg., Toronto, Ont.

Eustis Mining Company,
F. M. Passow, Manager, Eustis, Que.

The Norton Mining Co.,
Coaticook, Que.

Weedon Mining Co., Limited,
L. D. Adams, Pres., 609 Eastern Townships Bank Bldg., Montreal, Que

FELDSPAR

British Minerals Corporation,
605 McGill Bldg., Montreal.

Bush Winning,
N.-D. de la Salette, Que.

O'Brien & Fowler,
Union Bk. Bldg., Ottawa.

Watts and Noble,
Kirks Ferry, Que.

GOLD

Eustis Mining Co.,
Eustis, Que.

Kienawisik Gold Mines Limited,
Amos, Que.

The Kienawisik Gold Mining Co. of Portland, Maine,
18 Tremont St., Boston, Mass.

Martin Gold Mining Co.,
Amos, Que.

Northern Quebec Goldfields and Exploration Co.,
Three Rivers, Que.

Siscoe Mining Syndicate,
Amos, Que.

Joseph F. Stabell,
1127 Niagara St., Buffalo, N. Y.

Zinc Company, Limited.
Room 605, Eastern Townships Bank Bldg., Montreal

GRAPHITE

Bell Graphite Co., Limited,
Box 185, Buckingham, Que.

Consolidated Graphite Mining & Milling Co.,
Buckingham, Que.

Quebec Graphite Co., Limited,
R. C. Rowe & C. N. Daly, Managers, Buckingham, Que.

Laurentian Graphite, Limited,
St Rémi d'Amherst, Que.

North Quebec Mining Development Company, Limited,
Gédéon Fredette, St-Rémi d'Amherst, Que.

Plumbago Syndicate,
Excelsior Life Bldg., Toronto.

IRON & TITANIC IRON

American Titanic Iron Co.,
J. H. Boisvert, Parliament Bldg., Quebec City.

Baie St. Paul Titanic Iron Ore Co.,
J. O. Paré, Manager, Baie St. Paul, Charlevoix Co., Que.

The Loughborough Mining Co., Limited,
Sydenham, Ont.

Manitou Iron Mining Co.,
Jos. E. Globensky, 364 University Street, Montreal.

KAOLIN

The Canadian China Clay Co., Limited,
Huberdeau, Que.

MAGNESITE

J. F. Inglee,
94 Binscarth Road, Toronto.

International Magnesite Co., Limited.,
1055 Eastern Townships Bank Bldg., Montreal.

North American Magnesite Producers, Limited,
Calumet, Que.

Scottish-Canadian Magnesite Co., Reg'd,
P. O. Box 50, Grenville, Que.,

MARL

Canadian Whiting Co., Ltd.,
St. Jérome, Qué.

MICA

W. Ahearn, Jr.,
538 MacLaren St., Ottawa.

Wm. Argall.
Laurel, Que.

Blackburn Brothers,
Union Bank Bldg., Ottawa.

Brown Brothers,
Cantley, Que.

Calumet Mica Co.,
Campbell's Bay, P. Q.

Capital Mica Co., Limited,
W. Ahearn, Manager, St. Pierre de Wakefield, Que.

Chabot & Co.,
124 Rideau St., Ottawa.

Cross & Wilson,
Cascades, Hull, Que.

Dougherty Brothers,
Bouchette, Que.

Joshua Ellard,
Wright, Que.

James A. Fleet,
P. O. Box 782, Montreal.

H. T. Flynn,
106 Montcalm Street, Hull, Que.

J. B. Gauthier,
Box 226, Buckingham, Que.

J. B. Gorman,
Box 166, Buckingham, Que.

Wm. Gowan,
Holland Mills, Que.

John E. Hardman,
East Templeton, Que.

Keene Mica Products,
N.-D. de la Salette, Que.

Sylvio Lafortune Mining Co.,
Pointe Gatineau, Que.

The Laurentide Mica Company, Ltd.,
119 Queen Street West, Ottawa.

The Loughborough Mining Co.,
N. J. Sproule, Manager, c-o G. W. McNaughton, Sydenham, Ont.

A. Roy McDonald,
Mica, Pontiac Co., Que.

Alex. MacLaurin,
522 Board of Trade Bldg., Montreal.

La Mine Nationale de Mica Blanc, Ltée.,
71 Ste Anne St., Quebec.

McGlasham & Son,
Glenlivet, Que.

A. Nault,
Maniwaki, P. Q.

O'Brien & Fowler,
410 Union Bank Bldg., Ottawa, Ont.

W. L. Parker,
Buckingham, Labelle Co., Que.

Wallingford Bros.,
Banque Nationale Bldg., Ottawa, Ont.

Wallingford Mica & Mining Co.,
Perkins, Que.

Watts and Noble,
Kirks Ferry, Que.

MINERAL WATER

Abenakis Springs Company, Limited,
W. E. Watt, Manager, Abenakis Springs, Que.

J. N. Ducharme,
L'Epiphanie, Que.

Eaux Minerales Naturelles de St Vallier, Enrg.,
St Vallier, Bellechasse, Co., Que.

Alfred Ferland,
Village St. Benoit, Two-Mountains Co, Que.

Radnor Water Co., Limited,
17 St John St., Montreal, Que.

Cyprien Roy,
St. Germain, Kamouraska Co., Que.

D. Veillet & Cie.,
Ste. Geneviève, Batiscan Co., Que.

MOLYBDENITE

L. N. Benjamin,
108 Laurier Ave. West. N.

Daley Molybdenite Co.,
2011 Hughett Ave., Wis., U.S.A.

Dominion Molybdenite Co., Limited,
M. L. Foley, 12 Maynard Ave., Toronto.

The Height of Land Company.,
S. P. Wilson, Mgr., 316 St. James, St., Montreal.

St. Maurice Mines Co., Ltd.
c-o B. Neilly, 120 Bay St., Toronto.

Wood Molybdenite Company, Limited,
14 Metcalfe St., Ottawa, Ont.

NATURAL GAS

The Canadian Natural Gas Co.,
P. O. Box 2072, Montreal.

The National Gas Co., of Canada,
c-o Mr. E. B. Devlin, Hull, Que.

OCHRE AND IRON OXIDE

Argall's Oxide Mines,
P. O. Box No. 5, Three Rivers, Que.

Canadian Oxides and Ochres
436 Pie IX, Montreal.

Canada Paint Co., Limited,
Jos. Bradley, Manager, Red Mill, Que.

The Champlain Oxide Co.,
Lucien Carignan, Manager, Three Rivers, Que.

P. Jobidon,
12 Ste. Famille St., Quebec City.

François Ouellet,
Ste-Gertrude, Nicolet Co., Que.

PEAT

J. M. O'Brien, Ltd.,
511 Union Bk. Bldg, Ottawa.

Les Tourbières des Laurentides, Ltd.,
Ste. Flore, Que.

PHOSPHATE

Blackburn Bros.,
H. L. Forbes, Manager, Union Bank Bldg., Ottawa.

J. G. Higginson,
Buckingham, Que.

O'Brien & Fowler,
410 Union Bank Bldg, Ottawa.

Wallingford Mica & Mining Co.,
Banque Nationale Bldg., Ottawa.

Edward Watts,
19 Chestnut Park, Toronto, Ont.

SILICA, ROCK AND SAND

J. Bonnell,
Buckingham, Que.

Canadian China Clay Co.,
43 Victoria St., Toronto, Ont.

Cascades Silica Products Company,
103 St. Frs. Xavier, Montreal.

Consolidated Sand Company,
270 Ottawa St., Montreal.

J. B. Gorman,
Box 166, Buckingham, Que.

J. McClements,
Buckingham, Que.

G. Pedenaud,
Buckingham, Que.

A. Sicard,
St. Canute, Que.

Silica Products, Registered,
45 St. Alexander St., Montreal.

Temple Silica Sand Ltd.,
East Templeton, Que.

SILVER

Eustis Mining Co.
F. M. Passow, Manager, Eustis, Que.

Weedon Mining Company,
L. D. Adams, President, Weedon, Que.

Zinc Company, Limited.
Room 605, Eastern Township Nldg., Montreal.

TALC

J. N. Martel,
Belmina, Wolfe Co., Que.

Canada Paper Co. Ltd.,
Windsor Mills, Que.

Talc Development Co of Canada, Ltd.,
Mansonville, Que.

Geo. R. Pibus,
Knowlton, Que.

ZINC AND LEAD

Federal Zinc and Lead Co., Ltd.,
285 Beaver Hall Hill, Montreal, Que.

The New Richmond Mining Co.,
New Richmond, Que.

North America Mining Co.,
New Carlisle, Que.

Pierre Tétreault,
Room 416, Power Bldg., Montreal.

Zinc Company, Limited,
Notre Dame des Anges, Portneuf Co., Que.

BRICK

The Ascot Tile & Brick Co., Limited,
Ascot Corner, Que.

N. L. Auger,
Ville de St. Tite, Champlain Co., Que.

D. Bertrand,
St Victor de Tring, Que.

Brompton Clay Hills, Inc.,
Bromptonville, Que.

The Citadel Brick & Paving Block Co., Limited,
P. Galarneau, Manager, 320 St Paul St., Quebec City.

La Compagnie de Briques de l'Abitibi,
Amos, Que.

La Compagnie de Briques de Deschaillons,
Deschaillons, Que.

La Compagnie de Briques de l'Islet, Ltée,
L'Islet Station, Que.

La Compagnie de Briques de Matane,
St Jérôme de Matane, Que.

Jos. Desrochers,
Warwick, Que.

Rev. J. A. Grenier,
Mount Laurier, Que.

David F. Hodgins,
Box 87, Shawville, Que.

Nap. Loiselle,
Granby, Que.

Emile Longpré,
St. Félix de Valois, Que

W. E. Loomis,
Sherbrooke, Que.

National Brick Co. of Laprairie, Limited,
511, St. Catherine, West, Montreal.

Paradis & Letourneau,
Stadacona, Quebec City.

Ulderic Paris,
Village Deschaillons, Que.

Proulx Brothers,
Richmond, Que.

The St. Lawrence Brick Co., Limited,
71 St. James Street, Montreal, Que.

CEMENT

Canada Cement Co., Limited,
F. P. Jones, Manager, Herald Building, Montreal.

GRANITE

Aug. Bernier,
Roberval, Que.

James Brodie & Son,
Graniteville, Que.

Brodie's, Limited,
128 Bleury Street, Montreal.

Joseph Brunet,
663 Côte des Neiges Road, Montreal.

Wright W. Bullock,
Beebe, Que.

A. L. Bussières,
St. Henri Village, Levis, Que.

J. P. DeBlois,
St Samuel Station, Que.

Augustin Delisle,
Rivière à Pierre, Que.

Dumas & Frère,
Rivière à Pierre, Que.

William Duncan,
Graniteville, Que.

Filton & Parmenter,
North Derby, Que.

J. P. Gadbois,
326 Ave. Laval, Montreal.

J. C. Lacasse,
Beebe, Que.

Alphonse Lacroix,
St Sebastien Station, Que.

The Megantic-Stanstead Quarry Co., Ltd.,
5, Bleury St., Montreal.

Pierre Moreau,
Roberval, Que.

S. B. Norton.
Beebe, Que.

Mme Jos. N. Perron,
Rivière à Pierre, Que.

R. A. Rideker,
Graniteville, Que.

Stanstead Granite Quarries Co., Limited,
Beebe Jct., Stanstead Co., Que.

F. Voyer & Frère,
Rivière à Pierre, Que.

LIME

Arnaud & Beaudry,
Joliette, Que.

Adolphe Barron,
La Carrière, Que.

Delphis Beauregard,
Stukely, Que.

Arthur Boivin.
Pont Rouge, Portneuf Co., Que.

R. B. Carswell,
Bryson, Que.

Achille Desilets,
St. Louis de Champlain, Que.

Dominion Lime Co.,
Sherbrooke, Que.

Lucien Doucet,
St. Louis de Champlain, Que.

Emery Héon,
St. Louis de Champlain, Que.

Octave Héon,
St. Louis de Champlain, Que.

Laurentian Stone Co., Limited,
Hull, Que.

Johnny Lefebvre,
St. Louis de Champlain,

Lesvesque et Deschênes,
Mount-Joli, Que.

Thos. McCambly,
Kazubazua, Que.

Montreal Lime Co.,
31 Prenoveau St., Montreal.

Placide Sanche,
Ste Thérèse, Que.

Thos. Sharpe,
Coldwell, Que.

Sovereign Lime Company Limited,
Delorimier Ave. and C.P.R. Tracks, Montreal.

Standard Lime Co., Limited,
St. Paul, Joliette Co., Que.

St. Maurice Lime,
P. O. Box 479, Trois Rivières, Que.

Succession O. Limoges,
40 Pouport S.t, Montreal.

LIMESTONE

Jos. P. Beaudry,
Joliette, Que.

Louis Bertrand,
Shawinigan Falls, Que.

Joseph Blais,
8 Mount-Marie Ave. Lévis, Que.

Canada Carbide Company, Limited,
Power Building, Montreal.

Carrière de Québec, Limitéee,
15, rue St. Jacques, Quebec City.

La Cie des Carrières,
St. Marc des Carrières, Que.

La Cité de St-Hyacinthe,
St. Hyacinthe, Que.

La Cité de Hull,
Hull, Que.

Alderic Cousineau,
2455, St. Urbain Street, Montreal.

The L. Deguire Quarry Co.,
St. Laurent, near Montreal, Que.

The Delorimier Quarry Co.,
1952 Iberville St., Montreal.

Frank Deraiche,
Chandler, Gaspé.

Deschambault Quarry Corporation,
52 St. Paul St., Quebec City.

The Deschambault Stone Co., Limited,
St. Marc des Carrières, Que.

Edgard Desormeaux,
Cap St. Martin, Laval, P. Q.

Pite Desroches,
Joliette, Que.

R. C. Dickson,
601 Monsabré St., Montreal.

Cyrille Durocher,
5383 Notre Dame St., Montreal, Que.

The Federal Stone & Supply Co., Limited,
339 Queen St. Ottawa.

Martin Gagnon & Frères,
3363 Lajeunesse St., Montreal.

E. L. Gravel,
Château Richer, Que.

Francis Gravel,
Château Richer, Que.

Grondines Quarry Co., Ltd.,
704 Power Bldg., Montreal.

Institution des Sourds-Muets,
1941 St. Dominique St., Montreal,

Joliette Castings & Forgings Ltd.,
Joliette, Que.

Kennedy Construction Co., Limited,
310 Shaughnessy Bldg., Montreal.

The Félix Labelle Quarry Co., Limited,
St. François de Sales, Que.

Georges Labelle,
St. François de Sales, Que.

Joseph Lapointe,
Cartierville, Que.

Laurentian Stone Co., Limited,
53, rue Albert, Hull.

Edgar Lawrence,
Port Daniel, Que.

Victor Lecrenier,
Cap St. Martin, Cte. Laval.

Narcisse Lord,
St. Jean, Que.

Maisonneuve Quarry Co., Limited,
2855 Boulevard Rosemont, Montreal.

O. Martineau & Fils, Limited,
371 Marie Anne Ave., Montreal.

R. H. Miner & Co., Ltd.,
Guarantee Bldg., Montreal.

Montreal Crushed Stone Co. Ltd.,
590 Union Ave. Montreal.

Montreal Quarry Limited,
800 Bellechasse St., Montreal.

Jos. D. Naud,
St. Marc des Carrières, Que.

Jos. Poulin,
Château Richer, Que.

Richelieu Quarry Co., Ltd.
St. John, Que.

Thomas Rogers,
1701 Iberville Street, Montreal.

A. Simard,
Chambly, Que.

The St. Laurent Quarry, Limited,
Cap St. Martin, Laval Co., Que.

Standard Lime Co., Limited,
Joliette, Que.

Stinson-Reeb Builders' Supply Co Ltd.,
45 Alexander St., Montreal, Que.

Napoléon Tremblay,
Joffre Avenue, Hull, Que.

Elzéar Verreault,
191 rue de Pont, Québec.

Villeray Quarry Co., Limited,
848 Du Rosaire Street, Montreal.

Wright & Co., Inc.,
Hull Que.

MARBLE

The British Canadian Marble Co. Ltd.,
St Joseph de Beauce, Que.

The Pontiac Marble & Lime Co., Limited,
193 Sparks St., Ottawa.

Wallace Sandstone Quarries Ltd.,
Philipsburg, Que.

POTTERY

W. D. Bell,
1286 St. Valier St., Quebec City.

Canadian Trenton Potteries Co., Limited,
St. John's Que.
Citadel Brick & Paving Blocks Co., Ltd.,
Quebec.
Dominion Sanitary Pottery Co.,
189 James St., Montreal.

E. L. Farrar,
Iberville, Que.

David T. Hodgins,
Shawville, Que.

La Compagnie de Tuyaux de Drainages,
L'Islet Station, Que.

Montreal Terra-Cotta Lumber Co.,
511 Ste Catherine St., West.

Standard Clay Products Limited,
St. John's Que.

SAND

Atlas Sand Company, Limited,
77 Common St., Montreal.

Jean Aybram,
St. Emelie Junction.

The Bonner Sand & Ballast Co., Ltd.,
204 St. Nicholas Bldg., Montreal.

The Cairnie Construction Company
Lennoxville, Que.

Consolidated Sand Company,
270 Ottawa, St., Montreal.

Keystone Wall Plaster Co.,
Ste. Thérèse, Que.

Laurentide Co., Ltd.,
Grand'Mère, Que.

Laurentide Sand & Gravel, Ltd.,
77 St James St. Quebec.

Melançon & Frère,
Grand'Mère, Que.

Royal Moulding Sand & Gravel Co.,
St. Félix de Valois, Que.

Standard Lime Co., Ltd.,
Joliette, Que.

St. Félix Sand & Gravek Co.,
Joliette, Que.

Napoléon St. Louis,
Fontarabie, Maskinongé Co., Qué.

SANDSTONE

Cascades Silica Products Co.,
103 St. François Xavier St. Montreal.

Miles Lonergan,
147 Mountain Hill, Quebec.

Consolidated Sand Co., Ltd.
270 Ottawa St., Montreal.

Normand Normand,
St Romuald, Que.

H. F. Routhly,
Haileybury, Ont.

The Sydney Kirby Co., Ltd.,
213 Sussex St., Ottawa.

SLATE

The British Canadian Marble Company, Ltd,
St Joseph de Beauce, Que.

New Rockland Slate Co.,
Room 601, Southam Bldg, 128 Bleury St., Montreal.

Slate Products Co., of Canada Ltd.,
10 Cathcart St., Montreal.

STATISTICS OF ACCIDENTS

REPORTED FROM THE MINES AND QUARRIES DURING THE YEAR 1920

A. O. Dufresne

* The tables accompanying this report show that there has been a rather considerable increase in the number of workmen employed throughout the year in mining operations in the Province of Quebec. Nevertheless, the number of those who worked during variable periods is smaller; it dropped from 8,930 to 8,806, a decrease of 1.4%. Mining operations in general were more active than in the previous year, since the number of workmen, calculated on a basis of 300 working days, which was 7,161 in 1919, rose to 7,428, an increase of 3.7%. This increase is due to the resuming of operations in quarries caused by a revival of activity in building operations. This fact will be seen by examining the general table of production on page 10 of the general report. This report shows that the production of the quarries, which was $8,090,241 last year, rose to $12,054,857 being an increase of 50%. It must, however, be added that a considerable portion of this increase is due to the higher prices received this year. The *Labour Gazette*, published by the Department of Labour in Ottawa, on page 244 of its issue of February 1921, estimates the value of building operations for the year 1920 at $21,660,492, while the work done in the previous year did not exceed $15,166,851. This increase of 42% agrees with the figures gathered by the Bureau of Mines in connection with quarry operations.

Table IV shows that 3,124, 300-day workmen worked in the quarries this year while there were only 2,406 last year. This, therefore is an increase of 30 per cent.

The work in the mines properly so-called shows a decrease of 9.5%. From 4,755 man-years, in 1919, the figures for the mine workers who worked all the year, dropped to 4,304 for the past year. The Quebec mines, like those of other countries suffered

* Translated from the French.

from the condition of the world's market which is still overstocked with metals and minerals left over from the war.

TABLE I

Persons employed in the Mines, Quarries and annexed Mills in the Province of Quebec, during 1920.

Mines, Quarries and Mills	Number of men employed	Number of men calculated on 300 day basis	
	1920	1920	1919
Asbestos (quarries and mills)	3,795	3,533	3,806
Copper and Pyrite, Silver, Gold	133	61	164
Chrome (mines and mills)	143	99	138
Feldspar, Kaolin (mines and mills)	50	29	33
Graphite, mica, phosphate, (mines and mills).	249	141	141
Iron ore, Titaniferous ore, zinc and lead	192	122	161
Magnesite	210	194	141
Marl	12	3	.....
Mineral Water (springs and works)	9	5	8
Molybdenite	17	8	62
Ochre (pits and mills)	80	55	69
Peat	.....	.....	5
Quartz and Silica (quarries and mills)	79	53	27
Talc	6	1	
Brick, Pottery (clay pits and mills)	989	745	639
Cement (quarries and mills)	869	900	640
Granite (quarries and works)	286	243	177
Lime (quarries and kilns)	233	198	196
Limestone (quarries and dressing works)	1,089	777	556
Marble, Slate, Sandstone, (quarries and works)	214	184	136
Sand (pit and river sand)	151	77	62
	8,806	7,428	7,161

A glance at Table I will show that the copper, chrome, zinc, lead, and molybdenite mines are among the number of those in which there has been the most notable decrease. The asbestos mines also show a smaller number of workmen than last year, but this is in nowise due to decreased production for the reports of the operators show that in comparison with last year, there is an increase of 30% in the quantity of fibre sold. This increase is due

to the putting into practice of new methods of paying the men's work. In most asbestos mines the workmen are assigned to do specified work, when this is possible, and they are paid so much per ton. By this system the yield per man is greatly increased and the miners get very high wages, while finding means to reduce the working hours. They are paid according to the work done.

Work in quarries was very actively carried on during 1920. There was a considerable increase in the quantity of products, with the exception of pottery, and the number of men needed necessarily increased.

Table No. III gives in detail, for each substance, the number of men who found employment in the mineral industry and a number representing the workmen which the same mines and quarries would have employed if the staff had worked on the 300 days of the year without a break.

As for previous years, in order to enable a comparison to be made, the men's work has been reduced to a same denominator, the equivalent of the work of the man-year or the 300-day man. The reduction is very simple: one has but to multiply the number of working men by that of the working days and then divide by 300. We then have the 300-day workman or the man-year. In some mines where work is continuous from one year to another owing to the methods followed, we have more than 300 days work, and in this case, in the tables, it will be found that the number of men-years is greater than the number of workmen employed. There are certain disadvantages in connection with such reducing to a basis of 300 days, for it is then necessary that the number of working hours per day be the same for the various mines, etc. This is not the case. Thus, in most open—cast pits and in quarries, the men work ten hours a day, while in some underground mines the day is eight hours, including half an hour in the middle of the day for lunch. To get accurate figures, it would thus be necessary that the basis be in hours and not in days. Unfortunately the data supplied by the operators do not allow of accuracy being pushed so far.

TABLE II

	Number of workmen	Wages	Number of days' work	Number of 300 day workers
Producing mines	4,975	$5,624,506	1,269,256	4,231
Non-producing mines	148	74,586	21,861	73
Total	5,123	$5,699,092	1,291,117	4,304

Table No. II gives the number of workmen employed in the mines properly so-called and the wages earned during the year 1920. The 5,123 men did 1,291,117 days work which represents the work of 4,304 men working the whole year. The wages of these men amounted to $5,699,092; out of these 5,123 men, 148 were employed in the development of non-productive mines, that is to say those that did not sell any ore during the year. No account is taken in the latter item of the work required under the Mining Law for maintaining rights on mining claims. The principal mine that carried on development work without shipping any ore was the Federal Zinc and Lead Co. Ltd. whose property is situated in the township of Lemieux, county of Gaspé.

TABLE III

WORKMEN AND WAGES FROM 1910 TO 1920

YEAR	Number of workmen	Number of 300 day workers	Wages	Average Wages
1910	7,901	.....	3,152,753	.....
1911	7,846	.....	3,365,803	.....
1912	9,140	.....	4,450,410	.....
1913	8,925	8,611	5,401,702	.626
1914	8,971	6,956	4,291,735	617
1915	7,989	5,767	3,419,857	593
1916	8,263	6,601	4,447,293	674
1917	7,712	6,497	4,868,748	749
1918	7,791	6,350	6,149,448	968
1919	8,930	7,161	7,341,619	1,025
1920	8,806	7,428	9,820,431	1,322

The total of the wages paid to men working in the mining industry of the Province of Quebec during the year was $9,820,431, while in the previous year it was $7,338,369, the increase, therefore, being 33%. The total of the wages represents an average of $1,322 per 300-day man. In 1919 and 1918 the average wages were $1,025 and $968, respectively, while in 1915 they were only $593.

The figures representing the average wages are interesting inasmuch as as they show the successive increases the men were enabled to obtain, owing to the economic conditions that prevailed generally throughout the world during the past years. A year after the great war was declared, the current wage for workmen in the Thetford-Black Lake region was only $1.75 per day. The scarcity of labour and the abundance of demands during the four years that followed had the effect of raising wages and, during 1920;

the same class of workers got $4.25 per day. Some classes of specialized workmen got higher wages; others who did piece-work, frequently doubled the wages of common labour.

On the 11th of October, six hundred asbestos miners in Thetford struck for an average increase of 50 cents a day in their wages. After negociations lasting until the 11th November, the men returned to work on the same conditions as before the strike. Two mines were affected. It is calculated that those workmen lost a total of 15,800 working days.

TABLE IV

Workmen in	Number 300 days workers	Accidents		Total	per 1,000 300 day workers
		Fatal	Non-fatal		
Mines.....	4,304	20	296	316	73.4
Quarries.....	3,124	5	30	35	11.2
	7,428	25	326	351	47.3

During the year 1920, the operators of mines and quarries reported to the mines Branch 351 serious accidents, 25 of which were fatal. The number of accidents reported is slightly above that of last year. This must be attributed to the greater activity in working the quarries manifested during the building season. Reduced to a common denominator of 1,000 man-years, the number of accidents reported is 47.3, while it was 48.3 in 1919.

The tables and explanatory notes constituting the subject of this report are based on the two lists accompanying it. The first gives a summary of the series of fatal accidents; the second comprises those that did not result in loss of life, but were so severe that the victim could not go back to work for a period of ten days or more. These are the accidents which the Bureau of Mines considers serious and which the operators of mines and quarries are

obliged to report within the shortest delay possible under pain of the penalties provided by law.

Article 2213a, of the Mining Law reads as follows: "If while a mine or quarry is being worked, an accident takes place resulting in loss of life or serious injury, the person working the same or his representative at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirements of this article, shall be liable to the penalties provided in article 2207."

There were 25 fatal accidents, being an average of 3.36 per 1,000 man-years.

In previous years the average was 0.6; 4.5; 1.67 for 1917, 1918 and 1919 respectively. The average for the four years is thus 2.53. These figures compares favorably with those of the statistics of mining centres outside the Province. It must be inferred from this that the operators of mines and quarries in the Province of Quebec take an interest in securing the safety of their workmen and the men, on their part; are not unduly rash. Nevertheless, the education of the workmen in safety measures should be carried on.

The operators would render themselves and their men an appreciable service by redoubled activity in teaching their workmen the best preventive methods and by advising their foremen to be increasingly vigilant in supervising working conditions in the mines and quarries under their direction. Moreover, the operators should continue to put and keep in good order, safety appliances at places where an accident might happen; they should have proper methods for the inspection of machines and tools, so as to discover weakened parts in time and thus eliminate causes of accidents.

TABLE V

Accidents in Mines, Quarries and annexed plants in the Province of Quebec for 1920.

	Fatal		Non-fatal		Totals	
	No.	%	No.	%	No.	%
MINES:						
Underground	4	1.1	38	10.8	42	11.9
Open pits	14	4.0	144	41.0	158	45.0
Surface	....	....	60	17.1	60	17.1
	18	5.1	242	68.9	260	74.0
QUARRIES:						
In pits	3	0.9	19	5.4	22	6.3
Surface	1	0.3	10	2.8	11	3.1
	4	1.2	29	8.2	33	9.4
ANNEXED PLANTS:						
ANNEXED PLANTS:						
Concentrators	3	0.9	42	12.0	45	12.8
Shops	.....	....	10	2.8	10	2.8
Power Plants	....	....	3	0.9	3	0.9
	3	0.9	55	15.7	58	16.6
Totals	25	7.2	326	92.8	351	100%

It is instructive to note how the accidents reported to the Bureau of Mines are classified. Table V divides them into three great classes: the first comprises those that occurred in mines; the second, those in quarries, and the third those in annexed plants.

TABLE VI

Analysis of fatal accidents in Mines, Quarries and annexed plants in the Province of Quebec for 1920.

	Underground	Open Pits	Surface	Total	
				No.	%
MINES:					
Falls or slides of rock or ore.	1	7	....	8	44
Explosives	3	1	....	4	22
Cable Derricks	....	3	....	3	16
Steamshovel	....	1	....	1	6
Railroad	....	1	....	1	6
Fall	....	1	....	1	6
	4	14	....	18	100%
QUARRIES:					
Falls of rock	....	1	....	1	25
Railroad	....	....	1	1	25
Explosives	....	1	....	1	25
Electricity	....	1	....	1	25
	....	3	1	4	100%
ANNEXED PLANTS:	Concentrators	Shops	Power Plants		
Shafting	3	....	....	3	100
	3	....	....	3	100%

The accidents in mines are subdivided into those that occurred: (*a*) underground; (*b*) open pits, and (*c*) on the surface of the same mines. As there are no underground quarries in Quebec, the accidents in them are divided according as they occurred in pits or on the surface.

The accidents in annexed plants are subdivided according as they occurred: (*a*) in crushing, separating or concentration mills; (*b*) in repair shops, and (*c*) in power plants.

It will be seen that, in these statistics, no account is taken of accidents in working lime kilns, in cement mills after the crushing stage, nor in kilns where bricks are burned. Such operations belong to the class of manufacturing industries, as do also the accidents that occur in them.

TABLE VII

Analysis of non-fatal accidents in Mines, Quarries and annexed Plants in the Province of Quebec for 1920.

	Underground	Open Pits	Surface	Total	
				No.	%
MINES:					
Falls or slides of rock	17	64	1	82	33.9
Cable-derricks	....	34	5	39	16.1
Railroads	10	10	19	39	16.1
Falls	5	5	8	18	7.4
Miscellaneous	2	3	12	17	7.0
Steamshovel	....	7	....	7	2.9
Falls of object	....	2	5	7	2.9
Cranes	....	7	....	7	2.9
Explosives	2	4	....	6	2.4
Drilling	....	4	....	4	1.6
Machinery	....	....	4	4	1.6
Hammering rock or steel	....	3	....	3	1.4
Burns	....	....	3	3	1.3
Tools	....	1	2	3	1.3
Shaft	2	....	....	2	0.8
Steam	....	....	1	1	0.4
	38	144	60	242	100%
QUARRIES:					
Falls of rock	....	5	1	6	20.7
Explosives	....	5	....	5	17.3
Railroads	....	1	4	5	17.3
Drilling	....	4	....	4	13.8
Miscellaneous	....	....	3	3	10.3
Falls of object	....	1	1	2	6.9
Fall	....	1	....	1	3.5
Crane	....	....	1	1	3.4
Derrick	....	1	....	1	3.4
Steamshovel	....	1	....	1	3.4
	....	19	10	29	100%
ANNEXED PLANTS:	Concentrators	Repair Shops	Power Plants	No.	%
Shafting	10	3	1	14	25.5
Falls of objects	8	1	....	9	16.4
Machinery	8	....	....	8	14.5
Falls	5	1	1	7	12.7
Falls of rock	5	....	....	5	9.1
Miscellaneous	3	1	1	5	9.1
Tools	2	2	....	4	7.3
Hammering rock or steel	1	1	....	2	3.6
Burns	....	1	....	1	1.8
	42	10	3	55	100%

Tables VI and VII detail the causes of accidents according to groups of occupations. By studying them it will be seen to what points the operators' attention should be especially given when seeking means to eliminate the causes of temporary or permanent disability and even of loss of life.

In each of the yearly reports on accidents in mines and quarries, an effort has been made to indicate the methods to be followed to eliminate the causes of and to prevent those accidents. It is expedient to briefly repeat them here. The greatest number of accidents, fatal or non-fatal, both in mines and quarries are due to rock-falls and slides. In underground mines, they are the falling of pieces of ore that become detached from the roofs of the main drift or the walls of stope and other working-places. Careful examination by an experienced scaler, is indicated as the best way to prevent such unfortunate tragedies. In well organized mines there are gangs of miners whose sole work consists in examining the working faces and in barring down the parts of the rock that are fissured and threaten to fall. Moreover, every workman in arriving at the place where he is to work, must examine the roof and walls and make sure there is no piece of rock threatening his life. Such a method, if systematically carried out, will greatly reduce the number of accidents from falling rocks in underground mines. In open pits, some of which are as much as 300 feet deep, the superintendents should have ledges in the walls cleared of all loose stones. This work should be done immediately after blasting.

In seasons when stones are loosened by frost, very special attention must be given to the condition of the working faces. Quarrying by benches greatly reduces the danger of accidents by rock-falls. The limited area of the property does not always allow of this being done; and, for the workmen's safety, it is necessary that the depth of the open-cast pit be limited to a figure the factor whereof is the smallest dimension of the surface area of the quarry. To continue working the deposit it is then necessary to have recourse to an underground method. In the asbestos mines, to the east of Thetford Mines, the deposits of serpentine containing asbestos are in the shape of a thick sheet with a considerable dip. The encasing rock is a very quartzose sedimentary one. When the

serpentine has been cut down to a certain depth, a cross-section of work has the appearance of an inclined parallelogram. One side shows an even surface dipping towards the centre of the open cast pit while the opposite side, deviates from it with a dip varying between 60 and 80 degrees. This overhanging wall of sedimentary rock is apt to offer the danger of rock-falls. Notes on the condition of mines compiled by the Bureau of Mines show that, in the space of four years, three considerable rock-falls occurred in the Federal mine at Robertsonville where such conditions are to be found. During the winter of 1917, some hundred tons of the wall rock fell into the open pit. Fortunately none of the men were working at the time. In January 1918, the mine superintendent, during a daily inspection, noticed fissures on the surface in recently fallen snow. He ordered all the men to come out from the bottom of the pit. A few hours afterwards a great quantity of barren rock fell to the bottom of the pit. On the 2nd December last, four men out of six, who were working a steam-shovel at the bottom of the quarry were buried under a rock-fall from the south face. These men belonged to the night shift. According to the two men who miraculously escaped, no sign of danger was seen or heard. Those who had worked on the edge of the pit on the previous day had not seen any fissure on the surface. Moreover, a portion of the rock that had fallen was supported at one end by a pillar of serpentine that had not yet been cut down. The slice of rock that fell was 150 feet long, some forty feet high and about twenty feet thick. Such accidents show the necessity of vigilant watching of the condition of the overhanging walls and of cutting down the overhanging parts.

During the year, five persons (a quarry-man and four miners) were killed while handling explosives; two were asphyxiated by gas, while going too soon into a drift; one had an arm torn off while tamping a hole; another drilled into a hole that had misfired. These cases show why regulations were adopted forbidding going back to a working face in an underground mine until the gases produced by the explosion of dynamite have disappeared. The disappearance of these gases is hastened by means of forced ventilation. The handling of explosives is dangerous and they who do this work must be told the dangers connected with it.

TABLE VIII

Age of the Injured in 1920.

Accidents	15-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	Avove 65	Unknown	Total
Non-Fatal.....	59	50	46	34	26	17	18	15	7	3	2	49	326
Fatal.....	3	7	6	2	6	..	1	..	..	..	..	..	25
	62	57	52	36	32	17	19	15	7	3	2	49	351

TABLE IX

ROCK FALLS AND SLIDES, BY MONTH, DURING 1920

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
NON-FATAL													
Underground	7	2	2	2	..	..	1	1	..	..	..	2	17
Open Pits	3	7	8	7	3	5	8	6	4	3	4	6	64
Quarries	..	..	..	..	..	..	..	..	4	..	1	..	5
FATAL													
Underground	..	..	..	..	..	1	..	..	..	..	..	..	1
Open Pits	..	1	..	..	..	..	..	1.	..	1	..	4	7
Quarries	..	1	..	..	..	..	..	..	..	..	..	..	1
	10	11	10	9	3	6	9	8	8	4	5	12	95

Cable-derricks have also had many victims. These accidents are due to various causes:—faulty equipment, such as weak chains; the falling of stones while the derrick-boxes are being hoisted, or filled; the handling of the box at the bottom of the pit or at the surface while unloading. The most dangerous part of cable-derrick work is the loading of the boxes placed at base of the slope. The danger is in the many rock-slides caused in many ways. The principal way of preventing them is by giving the slope an angle of safety.

The introduction of steam shovels has greatly improved the conditions of this work and has contributed to lessening the number of these accidents. Thus, in 1916, 27% of the non-fatal accidents were of this class. This year those were only 16%. The use of locomotive-cranes has also contributed to reducing their number by doing away with aerial transportation. On the other hand, the tables give the accidents caused by steam-shovels and locomotive-cranes, but their number does not make up the difference indicated.

The putting in use of the two latter methods has brought about a development in the transportation by railway in mines. The number of accidents under this head has increased. It consists of 16% of the non-fatal accidents in mines and 17% in quarries.

With the development of mines and quarries, the transportation problem is assuming ever increasing importance. Whether it be in underground mines or in open workings, the causes of accidents under this head are practically the same. The following may be cited among the principal ones: loading of cars, making up of the trains, coupling and switching of the locomotives. The most frequent and most serious of all these causes, is the coupling of the cars and locomotives. This year there were one loss of life and several cases of permanent disability. These accidents are generally the result of breaches of the regulations framed by the company for the workmen's safety.

In the annexed plants: crushing, concentration and separation

mills, repair shops and the power plants, one fourth of the accidents are caused by shafting, pulleys, belts and gearing. Therefore the superintendent's attention should be given to these points. The first precaution to be taken is to cover the movable parts of the machines with guards preventing the workmen from coming into contact with them. In 1920, three men were killed and fourteen injured by shafting or the movable parts of machines.

Among the other causes of accidents, electric energy must be mentioned. In most mines and quarries electricity is used for lighting or for motive power. The distances separating from one another the machines driven by electricity, necessaitates wiring in proportion to the voltage of the circuit. As a rule the wiring is done according to all the rules of good workmanship. Danger occurs later, when, after some years of use, the insulating material is worn out and the wires are bare. A thorough inspection is then imperative, followed at once by the needed repairs. The mine managers should see that commutators are provided with isolating covers.

FATAL ACCIDENTS DURING THE YEAR 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Injury and Cause of Accident
1	Feb. 4	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Alf. Desruisseaux.....	30	Driller.....	Skull broken by stone which fell from top of open-cast pit.
2	Feb. 6	Black Lake Asbestos & Chrome Co., Ltd.	Emilien Martin.....	18	Labourer.....	Crushed under car, overturn by rock falling on it when chain of cable-derrick broke.
3	Feb. 25	Emile Perron's sand pit, St. Frederic, P. Q.	Philémon Lessard.....	25	Labourer.....	Buried under a cave-in of frozen earth, while under mining in a sand bank.
4	Feb. 26	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford-Mine.	Jules Bouchard.....	27	Driller.....	Slipped and fell to the bottom of the pit, fracturing his skull.
5	Aprl 3	Consolidated Asbestos Limited.....	Gaudias Gagnon.....	33	Driller.....	Found lying on the ground in the heading on the second level with the back of his neck and lower part of the back of his head much blackened and bruised.
6	Apr. 17	Consolidated Asbestos Limited.....	E. Tanguay.....	30	Millman.....	Whilst placing a belt upon a running pulley, the coat of the deceased in someway was caught, causing him to be thrown around the shaft.
7	Jnue 7	Blackburn Bros.....	Arthur Bouliane.....	40	Driller.....	Asphyxiated by dynamite fumes.
8	June 7	Blackburn Bros.....	Armand Bouliane.....	26	Driller.....	Asphyxiated by dynamite fumes.
9	June 15	Consolidated Asbestos Limited.....	Alonzo Forgues.....	17	Labourer.....	Instantly killed by a piece of rock which fell upon him from roof at entrance of pit end of tunnel.
10	July 24	Canadian Johns-Manville Co., Ltd.	William Lambert.....	24	Steam shovel ru'r.	While at work on steam shovel, man fell under drive shaft of engine.
11	July 30	Henri Lagueu'x Quarry.....	Onésiphore Bernier....	28	Quarryman.....	Killed while tamping a cartridge in a hole.
12	Aug. 10	Federal Asbestos Company.....	Odina Dorval.....	36	Labourer.....	Killed by fall of rock.
13	Oct. 4	Montreal Crushed Stone Co., Ltd..	Ernest Valade.....	38	Labourer.....	Electrocuted.
14	Oct. 28	North American Magnesite Producers Ltd.	M. Downey.....	48	Driller.....	Killed by fall of rock.
15	Nov. 12	The Pennington Asbestos Co.....	Joseph Demers.....	17	Electrician.....	Thrown into open cast pit by cable derrick.
16	Nov. 12	The Pennington Asbestos Co.....	Mederic Landry.....	23	Checker.....	Thrown into open cast pit by cable derrick.
17	Nov. 13	Bell Asbestos Mines.....	Joseph Turmel.....	23	Driller.....	Drilled into missed hole.
18	Nov. 17	Consolidated Asbestos Limited.....	Joseph Dumais.....	26	Millwright.....	Caught by revolving eccentric.
19	Dec. 2	Federal Asbestos Co.....	Liboire Delisle.....	35	Steam shovel.....	Buried under rock slide.
20	Dec. 2	Federal Asbestos Co.....	Arthur Lehoux.....	22	Labourer.....	Buried under rock slide.
21	Dec. 2	Federal Asbestos Co.....	Florian Grenier.....	25	Labourer.....	Buried under rock slide.
22	Dec. 2	Federal Asbestos Co.....	Donat Chateauneuf...	22	Labourer.....	Buried under rocjk slide.
23	Dec. 6	Canadian Johns-Manville Co., Ltd.	Harry Ramsay.....	39	Brakeman.....	Caught between locomotive and steam-shovel.
24	Dec. 13	La Compagnie des Carrières St. Marc.	Félix Blais.....	37	Mechanic.....	Caught by revolving shaft.
25	Dec. 16	Montreal Crushed Stone Co., Ltd..	Jacco Kueser.....	40	Brakeman.....	Fell between two cars.

DESCRIPTION OF FATAL ACCIDENTS

4th February.—At the Vimy Ridge mine, the property of the Bennet-Martin Asbestos and Chrome Mines Limited, Alfred Des Ruisseaux, 30 years of age, was killed by a fall of rock.

He was drilling at the foot of the quarry wall when large pieces of rock, weighing some sixty pounds each., became detached from the top of the face. Des Ruisseaux gave the alarm while running away The rock, as it fell, struck him on the head and killed him instantly. Examination of the body revealed a considerable fracture of the skull in the frontal region and wounds in both maxillae.

After firing the last mine preceding the accident, the whole of that part of the face had been carefully sealed.

Verdict: accidental death.

6th February.—At the Asbestos mine owned by the Black Lake Asbestos and Chrome Company Ltd., Emilien Martin was killed through the breaking of a chain while a very large stone was being lifted.

A large block, weighing over a ton had just been removed, from a pile of stones, and, for that puprpose, chains, whose links measured five eighths of an inch in diameter had been put around the stone. The stone had been carried over a truck by a cable-derrick; it was being lowered into it and the signal to stop had barely been given, when the chain broke, and its load fell on the truck from a height of three feet. The box of the truck swung from side to side and broke from its hinges, but remained on the truck. Emilien Martin was in charge of the loading of the cars and his work consisted in placing the loads properly. When the accident happened, he was on the ground near the car. No one can say how the accident happened. It is thought that he must have been struck by the box of the truck when it was driven from its place. The victim was picked up five or six feet from the car. He complained of sharp pains in his stomach and died a couple of hours later. Examination of the body revealed no fracture of any bones. On the body there was a large bruise, at the pit of the stomach showing where he had been struck. Death was probably due to rupture of the bowels causing internal hemorrhage.

Verdict: accidental death.

25th February.—Philémon Lessard, 25 years of age, was crushed at St. Frederic, Beauce, under a cave-in of frozen gravel which he had undercut.

The victim and other workmen were coming to get sand and gravel from the sand-pit, which was to be used in making a road during the following summer.

It was in winter and the ground was frozen to a depth of several feets. The men undercut the gravel deposit and let several feet of the frozen part fall. Moreover the roof rested on pillars with wide spaces between them. It was while they were working that the slide occurred crushing to death Lessard who had not time to escape.

26th February.—Jules Bouchard, 27 years of age, was killed by falling to the bottom of an open cast pit in the Thetford mine of the Bennett-Martin Asbestos and Chrome Mines. Ltd.

He was working on a narrow bench of rock on the south face of the open pit four or five feet from the surface and 130 feet from the bottom. He had just finished drilling a round of three holes and his assistant had left him a few moments before. Bouchard walked some steps along the bench and was preparing to get to the edge of the quarry when he was seen to slip on his stomach along the surface of the edge, turn over on his side and roll down to the bottom. He died in the hospital four hours later from fractures of the right leg and of the skull, in the temporal region.

At the spot where the accident happened, the face of the open working is vertical. At that season of the year, the edges and benches are covered with ice making them very dangerous to walk on. There were not sufficient natural steps for getting up from the bench to the edge of the pit, making access to it rather difficult. Moreover, owing the narrowness of the bench, the workman should have had at hand a well anchored cable as a security against possible falls.

3rd April.—At the mine of the Consolidated Asbestos, Ltd., Thetford Mines, Gaudias Gagnon, a drill-runner, was killed by an explosion, the cause whereof is unknown.

He was working alone at drilling holes in a drift of the second level. About 3.50 in the afternoon, the workmen heard the noise

of a muffled explosion. From the slightness of the noise, they thought that mines were being fired in a remote part of the property. Some ten minutes after, another driller, who had worked in the neighbouring cross-cut 100 feet away, passed near where the victim worked and found him lying with his face on the ground and his feet in the direction of the heading. The drill was in position, but without iês steel. Nothing seemed to indicate that any rock had fallen, either from roof or the walls.

The last mines had been fired 34 hours before and a mine hole eighteen inches deep, had missed fire.

Gagnon had drilled a parallel hole at a distance of eight inches, but when the hole was measured after the accident it was found to be five feet eight inches deep; which does away with the supposition that an accident had occurred through a mis-fire.

The victim was not supposed to have any explosive on his person. After the accident, the sixteen percussion caps, besides the four extra ones, given him for firing the mines were found intact about 350 feet from where the accident happened. The face of the front drift was in good condition, showing no traces of an explosion. Every hole was partly filled with dust. The victim's hat was found with the back torn as if by an explosion. The fragments were strung out near where his head lay after the accident, leading to the belief that a slight explosion had taken place some feet from the ground and that Gagnon was either lying or bent down at the moment of the accident.

The external examination of the body by the physician revealed no traces of violence on the upper and lower limbs nor on the head. There was no wound on the front part of the trunk; the upper part of left ear had been torn off. From the base of the neck to the middle of the back, there was a square wound from 8 to 10 inches wide. The skin around the wound had been torn and blackened in several places by something having the appearance of smoke. The muscles of the wounded part were torn and the wound was of a nature to suggest an explosion. It was evident that the victim had not been struck by a blunt object.

Verdict: death caused by an explosion, the cause and nature of which are unknown.

17th April.—Evangéliste Tanguay, 30 years of age, was killed

in the separating mill of the Consolidated Asbestos Company Ltd at Thetford Mines.

Tanguay, and another workman were replacing a belt on a main shaft, revolving at velocity of 250 revolutions per minute when his clothes were caught and rolled around the shaft, carrying him with them. Examination of the spot after the accident and the manner in which the clothing were rolled showed that the workman's woolen sweater had been caught at the height of the loins by a projection on the shaft caused by a blow with a cold chisel on the steel.

Moreover on the small pulley attached to the shaft, at a distance of three inches from the projection in question, there were two set screws whose nuts protruded by half an inch. The victim, like many other workmen in the Thetford mills wore his sweater and coat outside his overalls, which is contrary to all safe practice.

Verdict: accidental death. The company was held to have been guilty of negligence in leaving the shafting in bad order.

7th June.—At the Blackburn mine in the township of Templeton, Arthur and Armand Bouliane, were asphyxiated by gas from explosives.

The mining of the mica deposit in the Blackburn mine, at lake McGregor, is carried on underground. The mine is 260 feet deep and is divided into five levels. The first four have been worked out. At No 5 level there is a drift about fifty feet long. The Bouliane brothers were working at extending this drift. On monday, the 7th of June, at five o'clock in the afternoon, these two experienced miners had not finished drilling and preparing their mines. They remained at their work; while the other workmen left the mine. About eight o'clock, as they had not yet reached their home, a search was made and one of them was found lying at the foot of the ladder of the bottom of the pit and the other some fifteen feet, further off in the drift. Both were dead, with no marks of violence on their bodies. At the face of the drifts there were several holes that had not exploded. It is thought that, after going up to the fourth level while the mines were being fired, they found that some had not exploded and they went down to the fifth level before the gasses from the dynamite that had exploded, had sufficiently cleared off,

Verdict: accidental death.

15th June.—Alonzo Forgue, 16 years of age was killed by the fall of a block of rock in the mine of the Consolidated Asbestos Ltd., at Thetford Mines.

The victim was stationed in a cabin at the entrance of the long sloping tunnel of the Jacob mine at bottom of the pit. The station was about ten feet from the entrance of the tunnel. At 4.25 p.m., a block of rock that was overhanging the entrance to the tunnel, dropped and broke the front of the hut of the signal boy who was in front of his station and killed him.

According to the evidence given, blasts had been fired 20 feet above the part that fell at 12.30 p.m. At 1.15 p.m. the driller, Emile Lessard, who was in charge of the block-holing, noticed a fissure in the over-hanging block and called the foreman's attention to it. The latter consulted the head foreman, who told him to watch the fissure and that drilling would be done at 5.30 p.m. to cut down the block. According to another witness, water was running along the fissure at the roof of the tunnel and it seems agreed that all who were working in the vicinity, considered the fissure dangerous. One of the witnesses, a driller's assistant said that, at 3.30 p.m. he noticed a widening of the fissure.

The rock fell at 4.25 p.m.and buried the victim. Examination of the body revealed a fracture of the posterior part of the skull a driving in of the left side of the chest and a fracture of the left shoulder.

Verdict: accidental death with a recommendation to the company to be more watchful over the foremen.

24th July.—William Lambert, 24 years of age, the driver of a steam-shovel, at the Jeffrey mine was stuck by the connecting-rod of the machine and instantly killed.

Lambert, who was replacing the regular driver, fell under the movable parts of the driving machine while he was at his post on the steam-shovel and he was struck on the face by the head of the connecting rod.

30th July.—Onesiphore Bernier, a quarry-man, 28 years of age, was killed in the Lagueux, quarry at St Romuald, Levis county.

He was putting a half-stick of dynamite in a drill hole to clear

out the mud collected in it when the mine exploded and the tamping-rod he was using struck him under the arm and tore it off.

He died on the following day.

10th August.—Odinat Dorval, 35 years of age, was killed by the falling of a detached stone in the open cast pit of the Federal Asbestos Company at Robertsonville.

Dorval and some other men were working in the eastern part of pit removing the layers of loose earth covering the rock to throw it into the excavation in order to make a slope up which the ore could afterwards be taken up.

The place where the victim was working was a bench from 12 to 15 feet in height, the upper part of which ended at an old dump containing large blocks of stone. When the men began to work in the morning of the 10th August, none of them noted the existence of dangerous rock in that part of the bench. The foreman, a man of long experience, had passed there an hour before the accident. At ten o'clock a large stone, weighing nearly two tons, slipped from the pile of broken stones and struck Dorval who was working eight or ten feet below. It is possible that the heavy rain, that had fallen during the previous night, had washed away the underlying earth and weakened that on which the stone lay.

Examination of the body revealed a fracture of the spinal column, a breaking in on of the therax, fracture of three ribs and several contusions.

Verdict: accidental death.

4th October.—Ernest Valade, 38 years of age, was electrocuted in the quarry of the Montreal Crushed Stone Company Ltd., at St Vincent de Paul.

He was an electric drill-runner and was helping his companions in transporting the machine while hauling the cable containing the electric wires,, he was electrocuted and died an hour afterwards.

20th October.—Michel Downey, 48 years of age, a drill-runner was killed by a falling stone in the McPhee mine in Grenville township., the property of the North American Magnesite Producers Ltd.

He was drilling blast-holes in the bottom of the quarry when a stone that was being put in a cart at the surface on the edge of the pit, fell on him fracturing his skull and causing almost instantaneous death.

12th November.—Joseph Demers, 17 years of age and Medéric Landry, 23 years of age, were killed in the mine of the Pennington Asbestos Company of Thetford Mines by falling into an open cast pit.

In the Pennington Mine a railway track runs around the edge of the east part of the pit. The cable-derricks are placed transversely to the track. Near cable-derrick No 2, between the railway track and the contour of the excavation, there is a signal-post with two signallers. At the moment of the accident, a group of three men were stationed between cable-derrick No 2 and the signal-post. In the latter were two signallers and, beyond it, another workman. At the bottom of the pit some miners were moving large blocks of stone by means of the cable-derrick. While this is being done, it often happens that the hauling cable bends and touches the rails: At the moment when this happened an empty car which a locomotive was pulling in its place, struck the cable and dragged it about a dozen feet, striking one of the workmen and the signal-post. The shock threw three men to the bottom of the pit. Joseph Demers was found dead with a large fracture of the upper part of the skull and the brain full of fragments of bone.

Landry did not survive his many fractures and died two days later. The other workmen were also wounded.

The verdict of the coroner's jury was: accidental death.

13th November.—At the mine of the Bell Asbestos Mines of Thetford Mines, Joseph Turmel, 23 years of age, was wounded by a explosion of dynamite while drilling a hole in stone block. He died of his wounds on the 21st December.

The victim had but little experience in drilling holes; it was the fourth day he had been at that work. He belonged to a night shift, and had been assigned the work of drilling detached stones. The accident occured a few minutes after one o'clock in the morning. Turmel had, a few minutes before, begun to drill a hole in a large piece of detached stone when an explosion occured; the stone

broke into pieces. The bit of the drill was broken and Turmel was wounded in the face and head, and both his eyes were torn out. He was taken to the hospital where he died six weeks later, on the 21st December, of inflammation of the brain.

The jury's verdict was: accidental death, with a recommendation that blocks of stone be examined to avoid drilling into mis-fired holes.

17th November.—Joseph Dumais, 30 years of age, was mortally wounded in the separating mill of the Consolidated Asbestos, Ltd, at Thetford Mines where his work was repairing machinery.

About 7.45 p.m. the machine oiler asked Dumais to repair an oil cup whose spout was blocked. The cup was placed on an excentric which shook a separating table. That excentric was on a shaft about 36 inches from the floor, and making 320 revolutions per minute. The excentric was attached to the shaft by a key. The latter was not sufficiently sunk in, and protruded from the surface of the shaft by more than one eighth of an inch. According to the evidence given at the inquest, it appears that Dumais was drawing near the shaft opposite the cup where the key was, for the purpose of cleaning the feeding-tube of the oil-cup. At that moment his clothes were caught in the revolving shaft and wound around it, carrying Dumais with them. The machinery was stopped at once and the victim was taken to the hospital. The physician found many wounds, among others: in the hollow of the left axilla, contusions in the head and abdomen and fracture of the right ankle. He died three days later of the wounds in the abdomen and of the partial tearing off of his left arm.

This accident might have been avoided, if the unevenness of the surface of the shaft had been removed, which could have been done by driving in the key.

2nd December.—At the Federal mine, the property of the Federal Asbestos Company, at Robertsonville, Donat Châteauneuf, 22 years of age, Florian Grenier 25 years of age, Liboire Delisle, 35 years of age, and Arthur Lehoux, 22 years of age, were buried about 9 p.m. by the fall of a portion of the southern face of the open-cast pit.

The excavation is about 300 feet wide at the top and 100 feet

deep. The dimensions at the bottom are smaller in order to give a slope to the walls. This quarry is in an inclined band of serpentine, between walls of very quartzose sedimentary rock, dipping to the south at an angle of from 70 to 75 degrees. The part that fell represents a cut 20 feet wide, 40 feet deep and 146 feet long and forms the western extremity of the southern face. According to the witnesses who were heard at the coroner's inquest a part of the rock overhung at the eastern extremity, the other extremity was supported by the serpentine which dipped at an angle of 60 degrees towards the centre of the pit.No work was being done at the foot of the slope in the night when the accident occurred. The steam-shovel was removing the stone at the foot of slope transversely to the serpentine bed so that the accident cannot be attributed to an immediate weakening of the support of the sedimentary rocks caused by removal of rocks by the steam-shovel. Examination of that face of the quarry leads to the belief that there was a fissure of somewhat ancient date, because a rather considerable abundance of oxidation was seen on the first ten feet of that face. At the inquest it was impossible to ascertain whether any one had noticed a fissure on the day before the accident. It may be added that, on the eve of the accident, heavy rain had fallen for several hours and that afterwards the weather had become very cold. Nevertheless the cold had not been sufficient to freeze the water to a considerable depth in one fissure. Thus, the supposition of a force produced by the freezing of water in the fissure must be set aside. The accident must therefore be attributed to the development of weakness in the overhanging layers of rock exceeding the coherence of the layers. Thus, in future, no reliance should be placed in the safety of a wall whose upper part overhangs the excavation, even only slightly, and steps should be taken, in thecase of all excavations in open-workings in this bed of serpentine, to have all overhanging parts cut down and to give the quarry a vertical face on the south east side.

Such, morever, was the recommendation of the coroner's jury which they added to their verdict of accidental death.

Verdict: accidental death, with a recommendation to the company to have the sides of excavations cut so that there shall be no overhanging rocks.

6th December.—Harry Ramsey, 39 years of age, a brakesman in the employ of the Canadian Johns-Manville Company Ltd., was crushed to death between a locomotive and a steam-shovel.

While trying to couple the locomotive to the steam-shovel, he was caught. between the two and had his right leg broken in the upper third part of the femur, and received other wounds which caused his death two days afterwards in the hospital.

13th December.—Félix Blais, a machinist, 37 years of age, in the employ of La Compagnie des Carrières at St-Marc des Carrières, was killed by a shaft.

He was working in the stone sawing mill at a height of between 15 and 18 feet, when his clothes were caught and rolled around a main shaft, making from 500 to 600 revolutions per minute, and was thrown on the floor to a distance from 15 to 20 feet. Fracture of the skull caused instant death.

16th December.—At the St Vincent de Paul quarry of the Montreal Crushed Stone Company, Ltd, Tzeco Kucser, brakesman, 40 years of age; was killed while coupling a quarry-car to the locomotive.

The locomotive was coming up in answer to Kucser's signal, when he jumped on the front of the ccar's coupling and was rushed to death.

MINES, QUARRIES AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC

NON-FATAL ACCIDENTS DURING THE YEAR 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
1	Jan. 2	Black Lake Asbestos & Chrome Co., Ltd., Caribou mine	P. Benvenuto	28	Miner	A rock fell on him bruised his face, cut on right eye and cheek.
2	Jan. 2	Asbestos Corporation of Canada Ltd., King Mine	Oct. Roy	54	Labourer	Both eyes injured when fixing clay pump.
3	Jan. 2	Bennett-Martin Asbestos & Chrome Mines, Thetford Mine.	Louis Binette	49	Labourer	Foot crushed while handling a heavy piece of timber in the mill.
4	Jan. 5	Jacobs Asbestos Mining Co. Ltd.	James Morrison	32	Teamster	The injured man was walking beside his team when the sleigh skidded striking him on his left side.
5	Jan. 7	The Pennington Asbestos Company.	Arthur Talbot	30	Labourer	While loading bags from shed to sleigh, the pile of bags tumbled over burying Talbot, who suffered severe contusions to the left foot.
6	Jan. 8	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine	Joseph Gagné	28	Labourer	While splitting wood, struck left leg with axe.
7	Jan. 8	Jacobs Asbestos Mining Co. Ltd.	Jos. Gilbert	28	Shoveller	Struck on head by rock when loading car, underground.
8	Jan. 8	Jacobs Asbestos Mining Co. Ltd.	Napoléon Doyon	32	Shoveller	Struck on hip by a rock when at work in glory-hole.
9	Jan. 8	Jacobs Asbestos Mining Co. Ltd.	Elisé Lafrance	55	Foreman	Injured was jammed between two cars in pit while coupling them.
10	Jan. 9	Canadian Johns-Manville Co. Ltd.	Edgar Boucher	55	Brakeman	Fracture left hand finger, caught finger while breaking.
11	Jan. 9	Asbestos Corporation of Canada Ltd, King Mine.	A. Leblanc	19	Labourer	Third left finger fractured, when stone fell from side of pit.
12	Jan. 10	Asbestos Corporation of Canada Ltd, Beaver Mine.	A. Beauregard	32	Labourer	Head bruised struck by stone falling from cable-Derrick.
13	Jan. 10	Jacobs Asbestos Mining Co. Ltd.	L. W. Savoie	34	Shoveller	Right foot bruised, struck when rock rolled from chute when loading car.
14	Jan. 12	Asbestos Corporation of Canada Ltd, British Canadian Mine.	Theo. Charland	28	Labourer	Head cut by stone from a blast.
15	Jan. 12	Asbestos Corporation of Canada Ltd, Beaver Mine.	J. A. Bernard	30	Labourer	Left leg injured by falling stone.
16	Jan. 12	Jacobs Asbestos Mining Co. Ltd.	J. B. Boutin	39	Shoveller	Third finger right hand cut off when unblocking a chute.
17	Jan. 12	Jacobs Asbestos Mining Co. Ltd.	Thomas Jacob	34	Oiler	Injuries to right side of head, by falling rock while oiling bucket elevator.
18	Jan. 12	Jacobs Asbestos Mining Co. Ltd.	Art. Ainsley	20	Shoveller	Left side of face injured fall of rock in a slope.
19	Jan. 13	Jacobs Asbestos Mining Co. Ltd.	Ernest Rouleau	23	Driller	Right eye lost, contusions to face, left arm and leg, dynamite explosion when injured drilled into missed hole.

20	Jan.	13	Jacobs Asbestos Mining Co. Ltd...	Jules Bilodeau.....	18	Helper.....	Several wounds to face and left arm, caused by same explosion as foregoing case.
21	Jan.	13	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	H. Martineau.....	21	Fireman.....	Dropped a piece of wood on left foot, bruising same.
22	Jan.	14	Black Lake Asbestos & Chrome Co Ltd.	H. Maheu.....	45	Labourer.....	Cut to hand and head when struck by falling stone.
23	Jan.	14	Quebec Asbestos Corporation.....	P. Marcanin.....	30	Miner.....	Leg broken, a loose rock rolled on his leg while drilling in stope.
24	Jan.	15	Montreal Crushed Stone Co. Ltd...	E. Bélanger.....	28	Crusher tender...	Left foot toes sprained when lifting heavy casting.
25	Jan.	16	Asbestos Corporation of Canada, British Canadian Mine.	Phileas Turmel.....	20	Labourer.....	Lost both eyes when injured drilled into missed hole.
26	Jan.	16	Jacobs Asbestos Mining Co. Ltd...	Omer Duguay.....	23	Foreman.....	Sprained left side, in lifting a heavy gear.
27	Jan.	17	Asbestos Corporation of Canada Ltd, King Mine.	T. Guay.....	23	Labourer.....	Two fingers bruised by steel drill falling on fingers.
28	Jan.	20	The Pennington Asbestos Company.	Uldéric Tanguay.....	19	Miner.....	Contusions to the left leg, when rock rolled down from jam while loading cable-derrick box.
29	Jan.	21	Black Lake Asbestos & Chrome Co. Ltd.	Wilfrid Jacques.....	20	Brakeman.....	Tip of finger torn off when dumping car.
30	Jan.	21	Canadian Johns-Manville Co. Ltd..	Wellie Mathieu.....	—	Labourer.....	Contusion to right hand, stone struck hand when man at work in mill.
31	Jan.	28	Montreal Crushed Stone Co. Ltd...	Alex. Valade.....	30	Labourer.....	Left leg fractured when struck by plank. The injured with others was loading a heavy machine on a lorry when it toppled over.
32	Jan.	30	Canadian Johns-Manville Co. Ltd..	Omer Plamondon.....	—	Brakeman.....	Sprain of left knee, was caught between two cars when braking.
33	Jan.	31	North American Magnesite Producers Ltd., McPhee Mine.	Frank L. Davis.....	—	Surveyor.....	Dislocation of shoulder.
34	Feb.	3	Asbestos Corporation of Canada Ltd, King Mine.	Fred Fabre.....	52	Labourer.....	Sprained back, struck by stone falling from side of open cast pit.
35	Feb.	3	Bell Asbestos Mines.....	Alfred Savoie.....	32	Cobber.....	When cobbing crude in pit a small piece flew into his right eye.
36	Feb.	4	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Nap. Larochelle.....	30	Driller.....	He sustained a severe injury in the back when a stone fell from top of open cast pit.
37	Feb.	5	Asbestos Corporation of Canada Ltd, Beaver Mine.	Donat Turmel.....	20	Labourer.....	Cut to left thumb, finger caught when unloading a car.
38	Feb.	6	Bennett-Martin Asbestos & Chrome Co. Ltd., Vimy Ridge Mine.	Alf. Ruel.....	24	Driller.....	Rupture, strained at work.
39	Feb.	7	Consolidated Asbestos Ltd.....	Clovis Marcoux.....	—	Carpenter.....	Right wrist and right ear scalded in disconnecting a hot water hose.
40	Feb.	7	Consolidated Asbestos Ltd.....	Pierre Gosselin.....	22	Driller.....	Left hand and right leg injured by fall of rock in a stope.
41	Feb.	8	Consolidated Asbestos Ltd.....	Aug. Duval.....	19	Skip loader.....	The injured was lifting a trap to load skip and strained his stomach.
42	Feb.	9	Asbestos Corporation of Canada Ltd, King Mine.	Alf. Gaudreau.....	40	Labourer.....	Fingers bruised when caught between chain and shaft.
43	Feb.	11	Canadian Johns-Manville Co. Ltd..	Henri Pelchat.....	—	Labourer.....	Handle of hammer struck man between legs, causing slight swelling of testicles.

NON-FATAL ACCIDENTS 1920

No	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
44	Feb. 12	Asbestos Corporation of Canada Ltd., King Mine.	Jos. Aubin	29	Machinist	Finger cut, piece of machinery fell on his finger, while moving same.
45	Feb. 12	Consolidated Asbestos Ltd.	S. Baillargeon	18	Brakeman	Sprained foot in coupling cars underground.
46	Feb. 12	Consolidated Asbestos Ltd.	Ad. Aubin	17	Switch boy	The injured in some manner caught his left foot
47	Feb. 12	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	W. Martin	21	Labourer	A rock fell, crushing left heel.
48	Feb. 13	Asbestos Corporation of Canada Ltd., British-Canadian Mine.	Jos. Roberge	60	Labourer	Stepped on rusty rail.
49	Feb. 13	Consolidated Asbestos Ltd.	Henry Vallée	24	Millwright	While climbing stairs he slipped and struck his right knee on a step.
50	Feb. 14	Asbestos Corporation of Canada Ltd., British-Canadian Mine.	Désiré Turmel	21	Labourer	Had leg caught between car and locomotive.
51	Feb. 15	Quebec Asbestos Corporation	Oliva Pouliot	20	Shoveller	While riding on the car which conveys rock from face of drift to hopper, car jumped track, man was thrown between wall and car breaking collar bone.
52	Feb. 16	Bell Asbestos Mines	Jean Cloutier	55	Labourer	Big stone rolled from jam and hit left leg, bruises above ankle.
53	Feb. 17	Eastern Mining & Milling Co. Ltd., Huntingdon Mine.	Joseph C. Arnold	30	Trammer	Derailed car on level, dumped contents near shaft, one piece rolled down shaft striking the man on back of head.
54	Feb. 19	Bell Asbestos Mines	Alb. Lamontagne	20	Labourer	Big stone rolled from jam on injured's right hand
55	Feb. 19	Consolidated Asbestos Ltd.	Harry Kisz	27	Driller	While working at bottom of a raise, a rock fell and struck him on forehead.
56	Feb. 20	Asbestos Corporation of Canada Ltd., King Mine.	Ernest Hinde	18	Labourer	Right side injured when struck by a cable-derrick box in motion.
57	Feb. 21	Canadian Johns-Manville Co. Ltd.	Thomas Surtees	—	Locom. driver	While thawing out pipes on engine with waste, he was burned in the face.
58	Feb. 21	Consolidated Asbestos Limited	Ad. Corriveau	33	Machinist	Hoisting a piece of machinery with winch in machine shop, when handle of same slipped off, striking him on the left arm.
59	Feb. 23	Bell Asbestos Mines	Emile Landry	16	Signaller	Sprained ankle when jumping from roof of signal cabin.
60	Feb. 23	Asbestos Corporation of Canada Ltd., British-Canadian Mine.	Geo. Papovitch	47	Labourer	Chest bruised when struck by cable-derrick box in motion.
61	Feb. 23	Asbestos Corporation of Canada Ltd., King Mine.	Philippe Lafleur	26	Labourer	Right foot bruised by rock falling from side of pit
62	Feb. 24	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Etienne Lapointe	62	Labourer	Left ankle crushed when a piece of frozen earth fell on his foot.
63	Mar. 2	J. V. Bélanger Mining Co. Ltd.	Méderic Gagnon	33	Driller	Hands burned and face bruised. Premature explosion when examing electric switch.

64	Mar.	2	Consolidated Asbestos Ltd.	Alf. Mercier	18	Switchman	While opening a switch underground he sprained his right foot.
65	Mar.	3	Bell Asbestos Mines	René Jobbut	20	Labourer	A big stone rolled from the slope in the open-cast pit and struck his right ankle.
66	Mar.	4	Asbestos Corporation of Canada Ltd., King Mine.	A. Bisson	17	Labourer	Right foot bruised when caught between lorry and rail.
67	Mar.	5	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Georges Camiré	59	Labourer	Ruptured his side while lifting a heavy rock into a cable-derrick box.
68	Mar.	6	Asbestos Corporation of Canada Ltd., King Mine.	Achille Roussin	30	Labourer	Rock fell from side of open-cast pit struck him on leg and wrist.
69	Mar.	6	Johnson's Company, Thetford Mine.	Jos. Madore	30	Fireman	Slipped from top of boiler and fractured right foot
70	Mar.	8	Canadian Johns-Manville Co. Ltd.	Paul Beaudette	—	Electrician	While cutting through a piece of lath, knife slipped. and cut thumb.
71	Mar.	8	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Onésime Collette	60	Labourer	Crushed little finger in loading a cable-derrick box.
72	Mar.	9	Consolidated Asbestos Ltd.	Léo Létourneau	25	Box loader	Back twisted in loading a cable-derrick box.
73	Mar.	13	Asbestos Corporation of Canada Ltd., King Mine.	A. Corriveau	27	Labourer	Thumb cut in loading a cable-derrick box.
74	Mar.	16	Federal Asbestos Company	Lucien Nadeau	35	Labourer	In placing belt on pulley, it slipped and caught his. hand.
75	Mar.	17	Asbestos Corporation of Canada Ltd., King Mine.	Jos. Dion	44	Electrician	While unloading a box it fell on him.
76	Mar.	18	Canadian Johns-Manville Co. Ltd.	Edward Prince	—	Labourer	Premature blast injured his eyes.
77	Mar.	19	Asbestos Corporation of Canada Ltd., British-Canadian Mine.	Aimé Hébert	23	Labourer	Right leg sprained when caught between locomotive and car in tunnel.
78	Mar.	19	The Pennington Asbestos Co.	Joseph A. Fillion	44	Labourer	While loading a cable-derrick box, a stone fell from side of pit and struck Fillion, left arm broken and contusion of spine.
79	Mar.	20	The Pennington Asbestos Co.	Domias Labrie	46	Carpenter	Caught fingers while adjusting gauge on planer.
80	Mar.	20	Asbestos Corporation of Canada Ltd., King Mine.	M. Nadeau	22	Labourer	Bruises over body by rock falling from slope.
81	Mar.	20	Asbestos Corporation of Canada Ltd., King Mine.	W. Poulin	23	Labourer	Struck in the eye when part of drill broken, while drilling.
82	Mar	23	Bell Asbestos Mines	Pierre Noiron	35	Labourer	While barring down loose stones injured had foot caught between stones which twisted his foot.
83	Mar.	23	Asbestos Corporation of Canada Ltd., British-Canadian Mine.	Jos. Lagacé	37	Labourer	Bruises over body caused by rock falling from jam.
84	Mar.	25	Black Lake Asbestos & Chrome Co. Ltd.	Alfred Grenier	22	Labourer	Finger crushed in loading cable-derrick box.
85	Mar.	25	Asbestos Corporation of Canada Ltd., King Mine.	Alfred Beaudet	35	Labourer	Piece of rock fell from side of open-cast pit cutting scalp.
86	Mar.	25	Asbestos Corporation of Canada Ltd., Beaver Mine.	O. Corriveau	33	Labourer	Ruptured. Caught between two cable-derrick boxes.
87	Mar.	26	Consolidated Asbestos Ltd.	H. Michaud	36	Oiler	While moving a feed spout he cut his hand very badly on a bolt.
88	Mar.	26	Bennett-Martin Asbestos & Chrome mines, Ltd., Vimy Ridge Mine.	H. Morin	33	Millwright	Right side and thigh bruised in falling from platform,

NON-FATAL ACCIDENTS 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
89	Mar. 27	Consolidated Asbestos Ltd.	T. Paquet	17	Switch boy	Right leg cut and fractured: heel badly bruised, while travelling through inclined tunnel, some rock fell from roof.
90	Mar. 28	Consolidated Asbestos Ltd.	David Larkin	20	Driller	Bruise on back by rock falling from side of glory-hole.
91	Mar. 30	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	J.-B. Roy	36	Box loader	Left foot bruised when rock rolled on foot while loading crane-box.
92	Mar. 31	Bell Asbestos Mines	Joseph Jalbert	45	Labourer	Big toe bruised when injured had foot caught between cable-derrick box and a stone.
93	Mar. 31	Asbestos Corporation of Canada Ltd., King Mine.	A. Fillion	20	Labourer	Cut on head when rock rolled from jam.
94	Apr. 1	Consolidated Asbestos Ltd.	Chs. Dubuc	16	Rock picker	While unloading conveyor belt, had finger caught between two gears in motion.
95	Apr. 1	Consolidated Asbestos Ltd.	Alb. Gregoire	27	Crusher man	While canting a rock at crusher he had finger bruished between rock and crusher.
96	Apr. 1	Consolidated Asbestos Ltd.	Ged. Beaulieu	24	Labourer	Struck on the back and badly injured by cable-derrick box slacking down.
97	Apr. 1	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Pierre Aubé	33	Dumper	While attending to his work, a big rock left one of the boxes and struck the board's end of the platform making the claimant fell from the platform: in his fall he struck his head on the crowbar with force, and sprained his left shoulder.
98	Apr. 1	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Georges Gagné	58	Labourer	Several small stones fell from side of bank and struck injured making three bleeding scalp wounds.
99	Apr. 1	North American Magnesite Producers Ltd.	Joseph Tussier	—	Labourer	Leg broken.
100	Apr. 2	Asbestos Corporation of Canada Ltd., King Mine.	Frs. Girouard	27	Engineman	Struck thumb on brass slide of engine.
101	Apr. 3	Asbestos Corporation of Canada Ltd., Beaver Mine.	W. Perron	33	Labourer	Struck on head by stone falling from jam.
102	Apr. 5	Asbestos Corporation of Canada British Canadian Mine.	Arsène Houde	46	Labourer	Chest and back bruised, struck by empty cable-derrick box being lowered into pit.
103	Apr. 6	Consolidated Asbestos Ltd.	Jas. Donovan	49	Yardman	Kicked on ankle by horse he was driving.
104	Apr. 6	The Pennington Asbestos Co.	Alph. Trackey	46	Labourer	While placing a cable on sheave his left hand was caught in it.
105	Apr. 6	Canadian Johns-Manville Co. Ltd.	William Ward	—	Brakeman	Contusion of scalp and fracture of mastoid bone. Accident happened while braking.
106	Apr. 7	Canadian Johns-Manville Co. Ltd.	Napoléon Mailhot	—	Driller	Struck by fall of rock while drilling in open-cast pit.
107	Apr. 9	Asbestos Corporation of Canada Ltd., King Mine.	Art. Mailhot	—	Carpenter	Finger cut causing blood poisoning while at work in shop.
108	Apr. 10	Asbestos Corporation of Canada Ltd., King Mine.	Alex. Bernard	35	Labourer	Cable-derrick box fell on left foot.

109	Apr.	10	Canadian China Clay Co. Ltd.....	Adelard Ladouceur....	—	Shoveller.....	While cleaning side of open cut some rock rolling down struck deal on which this man was standing, he lost is balance and bruised his side in the fall.
110	Apr.	12	Consolidated Asbestos Limited.....	Herm. Létourneau....	27	Shoveller.....	While shovelling in inclined shaft at second level, the injured missed his footing, causing him to fall on a wire rope in motion which pulled his hand in the sheave thereby cutting off two fingers of left hand.
111	Apr.	14	Canadian Johns-Manville Co. Ltd..	Thomas Dionne.....	—	Jackman.....	While at work jacking up steam shovel was struck by a piece of iron.
112	Apr.	15	Canadian China Clay Co. Ltd.....	Philibert Tassé.....	54	Foreman.....	Bruised back caused by a small rock rolling from bank.
113	Apr.	15	Asbestos Corporation of Canada Ltd., King Mine.	S. Bertrand.....	25	Labourer.....	Pain at right side when struck by hopper wheel which slipped from his hands.
114	Apr.	16	Asbestos Corporation of Canada Ltd., King Mine.	J. Champagne.....	40	Labourer.....	Left hand bruised by rock which fell from jam.
115	Apr.	16	Asbestos Corporation of Canada Ltd., King Mine.	Art. Vallée.....	28	Labourer.....	Stone fell from jam and injured his side.
116	Apr.	16	Asbestos Corporation of Canada Ltd., Fraser Mine.	Alfred Vachon.....	27	Labourer.....	Chain block fell on hand while hoisting a crusher.
117	Apr.	20	Consolidated Asbestos Ltd.....	Jos. Bilodeau.....	21	Labourer.....	Little toe cut off, while breaking rock on grizzly underground another rock fell on his foot.
118	Apr.	21	Asbestos Corporation of Canada Ltd., Beaver Mine.	Alp. Dutil.....	22	Labourer.....	Left shoulder injured when rock fell from a cable-derrick box which was being hoisted.
119	Apr.	21	Asbestos Corporation of Canada Ltd., King Mine.	Roméo Rhéaume.....	36	Driller.....	Sprained his back while lifting his drill.
120	Apr.	21	Federal Asbestos Company.....	Ernest Corriveau.....	19	Labourer.....	Fell from trestle.
121	Apr.	23	Black Lake Asbestos & Chrome Co. Ltd.	H. Beaudoin.....	—	Millman.....	Finger bruised when caught between belt and pulley.
122	Apr.	23	Asbestos Fibre Mining Co.....	Félix Jacques.....	38	Fireman.....	Bruised shoulder, slipped and fell from platform of steam shovel.
123	Apr.	24	Montreal Crushed Stone Co. Ltd...	J. Kinser.....	37	Driller.....	Leg bruised when he upset his drill in trying hard to tighten a nut.
124	Apr.	26	Canadian Johns-Manville Co. Ltd..	Chs. McMahon.....	—	Jackman.....	Caught thumb between crane and steam-shovel.
125	Apr.	26	Consolidated Asbestos Ltd.....	L. W. Savoie.....	35	Shoveller.....	Cut on forehead when rock fell from chute rear which he was working.
126	Apr.	27	Asbestos Corporation of Canada Ltd., King Mine.	Ant. Landry.....	20	Labourer.....	Stone fell on right foot.
127	Apr.	28	Consolidated Asbestos Ltd.....	Alf. Bourgeault.....	39	Yardman.....	While unloading a dryer roller had finger cut off.
128	Apr.	29	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	A. Lamontagne.....	27	Box loader.....	Rock slipped off car and struck his shoulder.
129	Apr.	30	Weedon Mining Co., Ltd.....	Félix Lussier.....	23	Driller.....	Was assisting in replacing derailed skip in the main shaft, he slipped and fell down shaft some fifteen feet. Fracture of right knee.
130	May	1	Consolidated Asbestos Ltd.....	Pierre Roy.....	26	Shoveller.....	While loading cars at bottom of a chute, a plank on which he was standing slipped from under his feet knocking him down thereby spraining his wrist.
131	May	4	Asbestos Corporation of Can. Ltd., King Mine.	Geo. Delisle.....	75	Labourer.....	Fell off bench where he was seated. Bone of neck fractured.

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No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
132	May 5	Consolidated Asbestos Ltd	Alb. Gourde	33	Millman	While working on a crusher a small rock thrown by a belt in motion struck his right hand bruising his first finger.
133	May 6	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	J. Toussignant	22	Labourer	Was struck by stone on left foot.
134	May 7	Consolidated Asbestos Ltd	N. Ouellet	18	Skip loader	While loading skip a rock which fell from a chute struck his hand bruising it.
135	May 8	J. V. Bélanger Mining Co. Ltd	L. Leclerc	39	Labourer	In removing a small shed, Leclerc had foot caught when horses started suddenly. Broken leg.
136	May 12	Bell Asbestos Mines	Paul Vallée	26	Foreman	Walk on a rail in the tunnel.
137	May 13	The British Canadien Marble Co. Ltd.	Joseph Lessard	62	Teamster	Stone boat skided and struck left leg tearing the ligaments of left leg.
138	May 14	Canadian Johns-Manville Co. Ltd.	Oscar Michel	—	Millwright	Laceration of right hand finger. Hand slipped while holding chisel.
139	May 15	Asbestos Corporation of Can. Ltd., Beaver Mine.	W. Perron	33	Labourer	Had finger caught between drill parts.
140	May 18	Consolidated Asbestos Ltd	R. Veilleux	22	Dumper	While dumping cars in open cast pit, stomach hurt by car.
141	May 19	North American Magnesite Producers Ltd.	Robt. McKenzie	—	Labourer	Cut on leg and knee.
142	May 20	O. Martineau & Fils Ltée, Rosemont Quarry.	E. Lapierre	35	Driller	Had finger nearly torn off by explosion of electric detonator.
143	May 23	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	M. Slovic	46	Labourer	Right leg broken when struck by platform of steam-shovel.
144	May 4	Montreal Crushed Stone Co. Ltd.	F. Lepienna	53	Labourer	While removing ties one fell on his toes.
145	May 26	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	J. B. Roy	36	Box loader	Jammed index finger between rock and crane box.
146	May 27	The Pennington Asbestos Co	Alfred Dostie	18	Labourer	Left hand thumb crushed between two rocks.
147	May 29	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Albert Yendruck	50	Labourer	Scalpwound, ladder fell on his head.
148	May 29	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	J. Jarenzuck	28	Labourer	Knee bruised between rock and cable-derrick box.
149	May 31	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Eugène Goulet	30	Labourer	Ankle right foot bruised, caught between wheel-barrow and electric locomotive.
150	May 31	Consolidated Asbestos Ltd	Alph. Ouellet	21	Scaler	While barring loose rocks in glory-hole, a falling rock knocked him to bottom of glory-hole, bruising him over all his body.
151	June 1	Consolidated Asbestos Ltd	E. Lafrance	54	Foreman	While moving rail with a derrick same fell onto his foot.
152	June 2	Consolidated Asbestos Ltd	Ged. Larochelle	20	Dumper	While dumping boxes in pit, he had right thumb bruised between car and cable-derrick box.

153	June	1	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Joseph Laprise	20	Labourer	Finger crushed by stone which fell from side of open cast pit.
154	June	2	The Pennington Asbestos Co	Edward Gormley	25	Brakeman	While coupling cars, had left hand caught in couplings.
155	June	3	Asbestos Corporation of Can. Ltd., Fraser Mine.	Alcidas Roux	17	Millman	Traumatic pneumonia caused when he struck himself on screen while beating same.
156	June	3	Asbestos Corporation of Can. Ltd., Fraser Mine.	Sylvio Blais	24	Labourer	Left arm broken, bruises in face. Fell on belt while taking it out.
157	June	4	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Fred. Bonasso	23	Labourer	Stone rolled from jam and struck his left leg.
158	June	5	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Alphonse Dumais	69	Labourer	Sprained right shoulder while handling a pick.
159	June	5	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Honoré Carrier	50	Labourer	Blood poisoning in cut on hand made by sharp stone while loading cable-derrick box.
160	June	7	Asbestos Corporation of Can. Ltd., Fraser Mine.	Jos. Beaudettte	53	Teamster	Left shoulder broken when caught between steam shovel and car on which he was riding.
161	June	7	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Joseph Langlois	33	Brakeman	Two fingers crushed in coupling cars.
162	June	7	Consolidated Asbestos Ltd	A. Beaudoin	37	Shoveller	Left arm injured when he shipped while loading car at underground chute.
163	June	14	Montreal Crushed Stone Co. Ltd	H. Gravel	22	Driller	This man took shelter in a wooden building while blasting was going on. A small piece of rock crushed through the boarding and hit him on the back.
164	June	18	Federal Asbestos Company	R. Létourneau	24	Labourer	Foot crushed by piece of iron which fell on his foot.
165	June	18	Asbesros Fibre Mining Co	Paul Marcoux	17	Labourer	Right arm broken when handle of hand winch broke and struck his arm.
166	June	18	Asbestos Fibre Mining Co	Placide Lessard	18	Labourer	Right arm broken when handle of hand winch broke and struck his arm.
167	June	19	Montreal Crushed Stone Co. Ltd	Nicolo Ferralo	19	Labourer	While drilling with hand drill, a small piece of steel from drill flew to his eye.
168	June	19	Montreal Crushed Stone Co. Ltd	O. Tassé	22	Quarryman	Left foot slightly crushed by rock which fell from car.
169	June	21	Black Lake Asbestos & Chrome Co. Ltd.	John Hanson	19	Box loader	A stone fell on his right hand fracturing little finger.
170	June	25	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Adelard Roy	17	Labourer	Right leg bruised between draw bars of cars.
171	June	25	Black Lake Asbestos & Chrome Co. Ltd.	Chs. Richard	—	Labourer	A small piece of rock struck him in the eye causing rent of cornea.
172	June	26	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine	Fred Letarte	35	Yardman	While chopping, axe slipped, cutting left foot.
173	June	28	Asbestos Corporation of Can. Ltd., King Mine.	J. B. Desjardins	18	Labourer	Rock fell from jam and struck right leg.
174	June	29	Mutual Chemical Co. of Canada Ltd.	Félix Roy	45	Crusherman	While hammering rock, a small piece broke and struck him on the eye.
175	June	29	The Pennington Asbestos Co	George Donachy	30	Labourer	Left elbow badly bruised when struck by swinging rock.

NON-FATAL ACCIDENTS 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Jnjury
176	July 2	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Jos. Bergeron	51	Carpenter	Right thumb cut by piece of timber.
177	July 3	O. Martineau & Fils Ltée, Papineau Quarry.	Elie Crsapie	29	Blacksmith	Wound to left knee in shoeing horse.
178	July 3	Asbestos Corporation of Can. Ltd., King Mine.	Alf. Aubin	33	Labourer	Left foot injured when stone fell on foot.
179	July 3	Asbestos Corporation of Can. Ltd., King Mine.	Jules Côté	32	Labourer	Bruises over body when struck by loose rock falling from side of pit.
180	July 3	Consolidated Asbestos Ltd	O. Doyon	39	Hoistman	Right shoulder sprained while carrying a chain on his shoulder.
181	July 3	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Willie Thombs	20	Hoistman	While running hoist, he had index of right hand caught and crushed in the slide of hoist.
182	July 4	Consolidated Asbestos Ltd	Jos. Roy	27	Shoveller	Left hand finger bruised between rock and car, he was loading underground.
183	July 5	Asbestos Corporation of Can. Ltd., Beaver Mine.	Ant. Cappa	44	Labourer	Legs jammed by rocks falling from side of pit.
184	July 6	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Henri Morin	16	Labourer	Left hand cut by sickle.
185	July 7	Asbestos Corporation of Can. Ltd., Beaver Mine.	J. C. Provençal	35	Labourer	Struck by stone falling from cable-derrick box, right leg broken.
186	July 9	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Henri Grégoire	22	Box loader	Right ankle cut when rock rolled on it.
187	July 10	Mutual Chemical Co. of Canada Ltd.	S. Zatelevisky	32	Miner	Loose rocks fell on him, bruising his arms and legs
188	July 12	Asbestos Corporation of Can. Ltd., King Mine.	A. Grondin	18	Labourer	Stone struck right leg, bruising it.
189	July 12	O. Martineau & Fils Ltée, Papineau Quarry.	C. Demers	54	Stone cutter	Steel bar fell on big toe while trying to place dimension stone on saw bench.
190	July 13	Consolidated Asbestos Ltd	D. Vaillancourt	23	Shoveller	While dumping a box in a car he fell down on his right knee bruising it.
191	July 14	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Wilfrid Perron	24	Brakeman	While putting on breaks on car, he had knee caught between two cars spraining it.
192	July 15	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Jos. Bouffard	19	Labourer	Head bruised by falling bag.
193	July 17	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	G. Bennato	26	Labourer	Wound to scalp when struck by falling rock.
194	July 18	Mutual Chemical Co. of Canada Ltd.	Harry Keize	—	Miner	Compound fracture of ankle when he slipped off a stage.
195	July 19	Asbestos Corporation of Can. Ltd., Beaver Mine.	Tel. Martel	32	Labourer	Back injured when struck leg stones.
196	July 19	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	N. Fontaine	54	Box loader	Stone crushed fingers against side of crane box.

197	July	21	Asbestos Corporation of Can. Ltd., King Mine.	Hubert Ouellet	50	Labourer	Back sprained in lifting rock.
198	July	21	Montreal Crushed Stone Ltd.	E. Cadieux	29	Quarryman	This man was uncoupling two lengths of air hose when small stone lodged in one end flew out and struck his finger.
199	July	22	Consolidated Asbestos Ltd.	M. Onchal	23	Brakeman	Had leg badly bruised when caught between car and locomotive when latter left track.
200	July	23	Canadian Johns-Manville Co. Ltd.	Louis Morin	—	Crusherman	Right eye injured by blow from stone while man was at work on crusher.
201	July	24	Bell Asbestos Mines	Emile Doyon	17	Labourer	Instep of left foot bruised rock slipped off his hands while lifting it.
202	July	27	Canadian Johns-Manville Co. Ltd.	Arthur Côté	—	Millman	Contusion to right ankle caused by blow from stone passing down slip.
203	July	27	Canadian Johns-Manville Co. Ltd.	Edgar Boucher	—	Fireman	Infection to finger, bruised finger when at work firing locomotive.
204	July	27	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	L. Rush	36	Labourer	Right leg broken when rock fell from jam.
205	July	29	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Willie Aubert	27	Electrician	Left hand burnt by electric wire.
206	July	30	Levesque & Deschênes Quarry	Frs. Marchand	45	Quarryman	Amputation of right hand, premature explosion probably caused by spark from smoking pipe falling into detonator.
207	July	30	Levesque & Deschênes Quarry	Johnny Côté	28	Quarryman	Wound in face by same cause.
208	July	30	Levesque & Deschênes Quarry	A. Damour	45	Quarryman	Wounds over body by same cause.
209	Aug.	3	Canadian Johns-Manville Co. Ltd.	David Boisvert	—	Millman	Infection to left thumb accidently cut while at work in mill.
210	Aug.	4	Consolidated Asbestos Ltd.	J. Kesilut	45	Shoveller	Left side of back bruised by rock falling from underground chute.
211	Aug.	5	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine	Joseph Savage	38	Brakeman	While trying to couple cars had finger caught in couplings.
212	Aug.	7	Asbestos Corporation of Can. Ltd., King Mine.	Chs. Bernier	20	Labourer	Fell and cut finger on sharp rock.
213	Aug.	9	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Philias Gagné	49	Dumper	Left side rib fractured. Fell from car when he missed hook on cable-derrick box.
214	Aug.	10	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Fabian Orelis	26	Labourer	Left shoulder and back injured when struck by a stone.
215	Aug.	13	Asbestos Corporation of Can. Ltd., King Mine.	G. Wittebold	29	Cobber	Left hand finger injured by hammer in cobbing crude asbestos.
216	Aug.	14	Asbestos Corporation of Can. Ltd., King Mine.	T. Grondin	17	Labourer	Left foot injured when struck by cable-derrick box.
217	Aug.	14	Canadian Johns-Manville Co. Ltd.,	Joseph Gagnon	—	Labourer	Infection of a blister on left hand.
218	Aug.	14	Canadian Johns-Manville Co. Ltd.,	P. Labrecque	—	Brakeman	Severe lacerations of right hand finger, caught hand while coupling cars.
219	Aug.	19	Asbestos Corporation of Can. Ltd., Beaver Mine.	Jos. Beaulieu	19	Labourer	Right knee hurt, slipped on rock.
220	Aug.	20	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	C. Jacques	27	Labourer	Scalp wound, struck by stone falling from side of pit.

NON-FATAL ACCIDENTS 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
221	Aug. 20	Bell Asbestos Mines	Em. Giroux	21	Labourer	Injured was barring down loose rock in jam, when a big stone rolled and jammed his right leg against another stone.
222	Aug. 21	Federal Asbestos Company	Alphonse Turgeon	45	Labourer	Laceration to thigh when he slipped in trying to put on belt.
223	Aug. 21	Canadian Johns-Manville Co. Ltd.	Roger Laforest	—	Labourer	Right hand finger badly lacerated in unloading freight.
224	Aug. 21	Asbestos Fibre Mining Company	Arthur Lachance	30	Foreman	Right arm broken below elbow when he tried to place belt on pulley.
225	Aug. 23	Montreal Crushed Stone Co. Ltd.	R. Brunet	—	Labourer	Finger cut off when caught in jaws of clam shell bucket unloading coal.
226	Aug. 24	Asbestos Corporation of Can. Ltd., Beaver Mine.	M. Doyon	50	Labourer	Right wrist cut when he fell on sharp stone.
227	Aug. 24	Canadian Johns-Manville Co. Ltd.,	D. Gauthier	—	Millman	Hurt finger on point of drill steel.
228	Aug. 24	Canadian Johns-Manville Co. Ltd.	O. Bruneau	—	Machinist	While holding punch for man repairing piston on shovel in machine shop, small piece of iron flew into man's eye.
229	Aug. 24	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Nap. Poulette	51	Box loader	Fingers of left hand injured by rolling stone.
230	Aug. 26	Asbestos Corporation of Can. Ltd., King Mine.	Jules Dufresne	36	Labourer	Struck by falling cable.
231	Aug. 26	National Brick Co. of Laprairie Ltd., Delson plant.	Bruno Gravel	18	Machinist	In placing dryer car transfer on track had finger crushed against rail.
232	Aug. 27	Canadian Johns-Manville Co. Ltd.	D. Marcotte	—	Labourer	Hurt by dipper bucket of steam shovel.
233	Aug. 27	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Ed. Hébert	26	Labourer	Ankle sprained when cyclone shaft fell on his foot
234	Aug. 27	Asbestos Corporation of Can. Ltd., Beaver Mine.	L. P. Daigle	22	Labourer	Palm of left hand bruised, hurt by sliding rope he was holding.
235	Aug. 30	Montreal Crushed Stone Co. Ltd.	M. Sauriol	55	Labourer	Hip bruised when struck by water pipe, while riding on running board of motor truck.
236	Aug. 30	Bennett-Martin Asbestos & Chrome Co. Ltd., Vimy Ridge Mine.	Siméon Gilbert	25	Box loader	Foot crushed by fall of rock.
237	Aug. 31	Weedon Mining Co. Ltd	Z. Després	37	Pipe fitter	Fractured nose, upper jaw, cuts on head. The man was repairing a roller under station platform. He was laying down reaching under platform, his shoulders and head being in the path of skip in the shaft. He did not hear the descending skip which struck him on the head and threw him unto the empty skip.
238	Sept. 3	Federal Asbestos Company	Jos. Poulin	60	Labourer	Some men where removing an old cable-derrick when the dead-man holding cable suddenly gave way, the cable striking him on the legs.

239	Sept.	4	Bell Asbestos Mines	Geo. Fillion	29	Foreman	Injured had left leg caught between two panels used to receive crude ore.
240	Sept.	4	Canadian Johns-Manville Co. Ltd.	Geo. Bilodeau	—	Driller	Wire on cable of core drill punctured finger.
241	Sept.	7	Canadian Johns-Manville Co. Ltd.	Ern. Boisvert	—	Labourer	Rock rolled from bank and struck man on heel.
242	Sept.	7	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Wm. McGraw	21	Box loader	Right hand finger crushed against crane box.
243	Sept.	7	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Jos. Giguère	63	Labourer	Right finger hurt by falling beater.
244	Sept.	8	Consolidated Asbestos Ltd.	Jos. Lainé	20	Electrician	While opening a main switch (2,200 volts) a spark from the blade burnt his eye thereby lost sight of right eye.
245	Sept.	9	Montreal Crushed Stone Co. Ltd.	V. Desormeaux	—	Brakeman	Punctured foot by stepping on rail.
246	Sept.	10	O. Martineau & Fils Ltée., Papineau Quarry.	Nelson Poirier	42	Carter	Kicked by horse.
247	Sept.	12	Consolidated Asbestos Ltd.	P. Guay	20	Electrician	While handling two live wires same slipped from his hands and burned right hand.
248	Sept.	18	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Ant. Tanguay	25	Box loader	Left thumb bruised between rock and crane box.
249	Sept.	20	O. Martineau & Fils Ltée, Rosemont Quarry.	Alf. Belisle	34	Driller	Finger crushed by fall of rock.
250	Sept.	22	New Rockland Slate Co.	C. McGill	22	Quarryman	Struck on head by falling stone.
251	Sept.	22	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Ant. Vachon	28	Labourer	Finger bruised when caught between big stones.
252	Sept.	25	Louis Bertrand's Quarry	Jos. Bornais	63	Quarryman	Right leg fractured by rock falling from jam.
253	Sept.	28	Montreal Crushed Stone Co. Ltd.	Leo Zappio	23	Steam shovel man	Sprained leg, struck by rock rolling from jam.
254	Sept.	30	Bell Asbestos Mines	A. Richardson	52	Labourer	Big rock rolled from jam, fracturing his shoulder bone, ribs on left side and badly dislocating left knee.
255	Sept.	30	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	L. Jalbert	—	Driller	Right hand and leg injured by loose rock sliding on him.
256	Oct.	1	Asbestos Corporation of Can. Ltd., King Mine.	R. Richard	25	Labourer	Right arm broken when caught by shaft in mill.
257	Oct.	2	Johnson's Company, Black Lake Mine.	C. Guilmette	50	Labourer	Struck on back by a piece of trestle which fell on him, straining his back and leg.
258	Oct.	4	Asbestos Corporation of Canada Ltd, Beaver Mine.	J. Bouchard	23	Labourer	Left foot jammed between locomotive and car.
259	Oct.	6	Bell Asbestos Mines	Gédéon Perron	31	Labourer	Right leg bruised when foot was caught between two cable-derrick boxes.
260	Oct.	8	Asbestos Corporation of Can. Ltd., Fraser Mine.	Art. Cormier	38	Crusherman	Two fingers cut when hand was caught in a saw, in shop.
261	Oct.	8	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	W. Perron	24	Labourer	Left foot crushed by rock falling from side of open cast pit.
262	Oct.	8	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	P. L. Gagné	42	Labourer	While loading a waggon he fell off causing injuries to both arms and legs.
263	Oct.	8	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	H. Chenevert	32	Loader	Right hand hurt: crushed between crane box and rock.
264	Oct.	11	National Brick Co. of Laprairie Ltd., Laprairie plant.	John Traversy	24	Labourer	While laying rails his finger was caught under the rail and was badly cut.

NON-FATAL ACCIDENTS 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
265	Oct. 12	Montreal Crushed Stone Co. Ltd...	Jacco Kueser.....	38	Well driller.....	This man was operating the clutch and in so doing placed his hand where it was struck by the crank.
266	Oct. 12	The Pennington Asbestos Co.....	Nap. Beaudoin.....	—	Labourer.....	While placing large rock in car on surface, the side fell and struck the man causing fracture of bones of right hand.
267	Oct. 13	Bell Asbestos Mines.....	Emile Doyon.....	18	Labourer.....	Struck on arm by rock falling from the jam.
268	Oct. 15	Canadian Johns-Manville Co. Ltd..	Em. Bourque.....	—	Brakeman.....	Man slipped and caught his hand between parts of car.
269	Oct. 15	Consolidated Asbestos Ltd.....	O. Jolicoeur.....	18	Blaster.....	While barring loose rock in glory-hole, he got his back squeezed between two rocks.
270	Oct. 16	Consolidated Asbestos Ltd.....	James E. Beattie.....	17	Electrician.....	While going down the incline shaft on a car, he got his hips bruised by being squeezed between the side wall of the incline and the car.
271	Oct. 18	Zinc Company Ltd.....	Francis Dufour.....	38	Timberman.....	Fell and struck car standing below chute while repairing same.
272	Oct. 21	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Ernest Hainse.....	25	Labourer.....	While standing in the bottom of open cast pit he did not see a cable-derrick box which was being lowered which struck him.
273	Oct. 22	Consolidated Asbestos Ltd.....	W. Bernard.....	18	Labourer.....	White barring loose in glory-hole, his crow bar slipped, causing him to fall and injuring his left arm.
274	Oct. 23	Consolidated Asbestos Ltd.....	W. Lemay.....	49	Yardman.....	While hauling with a dump cart, he fell from it thereby injuring his left hip.
275	Oct. 25	Consolidated Asbestos Ltd.....	Jos. Gilbert.....	42	Carpenter.....	While lifting a piece of timber in yard had his left leg bruised.
276	Oct. 26	New Rockland Slate Co.....	Nl Leveillé.....	53	Driller.....	Slipped on piece of soapstone and in falling broke right wrist.
277	Oct. 26	Canadian Johns-Manville Co. Ltd..	Ed. Gervais.....	—	Repairer.....	Lifting heavy weight, slipped and sprained knee.
278	Oct. 27	Maisonneuve Quarry Co. Ltd.....	Amédée Larivée.....	33	Quarryman.....	In yard, struck by flying piece of rock.
279	Oct. 28	Asbestos Corporation of Can. Ltd., Fraser Mine.	Ant. Vachon.....	19	Labourer.....	Fell from load of bags, right leg broken.
280	Oct. 28	Quebec Asbestos Corporation.....	Paul Goulet.....	18	Helper.....	Goulet wanted to tighten a grease cup inside of drum on steam shovel, the drum slacked very slowly and Goulet's arm was caught between the drum and gear of hoist.
281	Oct. 28	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Omer Gosselin.....	40	Blacksmith.....	Slipped on steel box in shop.
282	Oct. 29	Canadian Johns-Manville Co. Ltd..	Alp. Morisette.....	—	Labourer.....	Numerous cuts and abrasions of arm, neck and leg: went over dump with two cars and locomotive.
283	Nov. 1	Montreal Quarry Ltd.....	Ph. Charron.....	40	Labourer.....	Finger caught in dumping loaded car.
284	Nov. 2	Canadian Johns-Manville Co. Ltd..	G. Mailhiot.....	—	Machinist.....	Heavy I beam fell on finger, severing same.

285	Nov.	2	The Pennington Asbestos Co.	A. Legaré	18	Labourer	While loading boxes in the open cast pit he had hand and wrist caught between two cable-derrick boxes.
286	Nov.	6	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Alex. Bomback	56	Labourer	Finger crushed between stone and cable-derrick box
287	Non.	9	North American Magnesite Products Ltd.	L. Villeneuve	—	Labourer	Severed tandon of second finger of right hand, while at work on surface.
288	Nov.	11	Canadian Johns-Manville Co. Ltd.	R. Bélanger	—	Labourer	Plank fell on right foot.
289	Nov.	12	The Pennington Asbestos Co.	Alb. Gauthier	15	Signaller	Signal shack was swept into pit by block rope of cable-derrick which was caught by locomotive.
290	Nov.	12	The Pennington Asbestos Co.	Alf. Fortier	15	Signaller	Signal shack was swept into pit by block rope of cable-derrick which was caught by locomotive.
291	Nov.	12	The Pennington Asbestos Co.	Léo Côté	40	Repairer	Signal shack was swept into pit by block rope of cable-derrick which was caught by locomotive.
292	Nov.	20	Canadian Johns-Manville Co. Ltd.	W. Vincent	—	Millman	While loading car, man fell down slip at Mill No. 3 and injured wrist.
293	Nov.	20	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	E. Pelori	31	Labourer	Both legs bruised when struck by stone from jam.
294	Nov.	20	The Pennington Asbestos Co.	Théophile Lessard	—	Oiler	While cementing belts he was caught in a shaft resulting in cuts on head and face and bruised to left shoulder.
295	Nov.	20	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Alfred Paquin	24	Labourer	Foot bruised by falling stone.
296	Nov.	22	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	Omer Fortin	18	Labourer	Fell on rails from car, ankle sprained.
297	Nov.	25	Asbestos Corporation of Canada Ltd, King Mine.	B. Fortin	40	Labourer	Had finger caught between two cable-derrick boxes
298	Nov.	25	Asbestos Corporation of Can. Ltd., King Mine.	W. Dodier	18	Labourer	Left leg bruised by piece of rock which rolled from jam.
299	Nov.	25	Bell Asbestos Mines	Em. Landry	17	Brakeman	Ribs fractured when thrown on frame of car while shunting cars in drift.
300	Nov.	27	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge Mine.	Alf. Marceau	44	Loader	Struck on forehead by piece of rock.
301	Nov.	30	Bell Asbestos Mines	B. Landry	48	Labourer	While loading a cable-derrick box a big stone rolled from a jam fractured bones of instep of left foot,
302	Nov.	30	Montreal Quarry Ltd.	Léon Brière	25	Labourer	Cut on forehead when struck by falling rock.
303	Dec.	1	O. Martineau & Fils Ltée, Papineau Quarry.	Joseph Lesage	43	Carter	While unloading stone from truck with derrick one slipped, fracturing his right leg.
304	Dec.	1	Canadian Johns-Manville Co. Ltd.	L. Michaud	—	Labourer	Piece of steel flew and struck man in eye while he was working steel in machine shop.
305	Dec.	2	J. V. Bélanger Mining Co. Ltd.	Albert Nogent	28	Mechanic	Amputation of finger after blood poisoning had set in it, after finger was jammed under a steel plate while relining chute of crusher.
306	Dec.	3	Asbestos Corporation of Can. Ltd., Beaver Mine.	L. Lachance	28	Labourer	Left leg bruised: was struck by a tie when rock fell on same.
307	Dec.	6	Johnson's Company, Thetford Mine.	A. Bois	—	Labourer	Was standing on a step ladder and it spread out, causing the man to fall on his elbow fracturing small bone.

NON-FATAL ACCIDENTS 1920

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
308	Dec. 7	Black Lake Asbestos & Chrome Co., Ltd.	Arthur Cyr	18	Dumper	While dumping a cable-derrick box into a car he had his right hand caught between side of car and the box chain, spraining his thumb.
309	Dec. 10	Canadian Johns-Manville Co. Ltd.	Aimé Bourassa	—	Labourer	Large stone rolled on man's ankle while car was being dumped at mill.
310	Dec. 11	Consolidated Asbestos Ltd.	T. Routhier	46	Shoveller	While working in glory-hole, a fall of rock struck him on the hip bruising it.
311	Dec. 11	Consolidated Asbestos Ltd.	Nap. Jolicoeur	20	Driller	Bruised and slight cut on forehead when struck by rock which fell from side of oepn cast pit.
312	Dec. 13	Asbestos Corporation of Can. Ltd., Beaver Mine.	Eug. Dubreuil	23	Labourer	Had finger caught between rock and cable-derrick box.
313	Dec. 15	Black Lake Asbestos & Chrome Co. Ltd.	Jos. Labrecque	44	Labourer	Back bruised by fall of rock in open cast pit.
314	Dec. 16	Consolidated Asbestos Ltd.	Géd. Vallée	22	Shoveller	While putting on a rubber gasket on his carbide lamp, same caught fire, thereby burning him to face and eyes.
315	Dec. 18	Asbestos Corporation of Can. Ltd., Beaver Mine.	V. Huise	54	Labourer	Left wrist broken when hand caught between two rocks.
316	Dec. 18	Canadian Johns-Manville Co. Ltd.	H. Lemay	—	Labourer	Contusion and punctured wound to big toe when heavy rock fell on man's foot.
317	Dec. 20	Black Lake Asbestos & Chrome Co. Ltd.	John Shewczak	30	Labourer	Infection in finger.
318	Dec. 20	National Brick Co. of Laprairie Ltd., Delson plant.	Ed. Houghting	40	Loader	While closing car door, jammed and broke his finger between frame and door.
319	Dec. 20	Asbestos Corporation of Can. Ltd., King Mine.	Ovide Gagnon	29	Labourer	Right leg bruised when struck stone falling from side of open cast pit.
320	Dec. 20	Asbestos Corporation of Can. Ltd., King Mine.	Réal Paquet	19	Engineman	Leg broken: fell from trestle when running after his locomotive.
321	Dec. 21	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	A. Youdruck	49	Labourer	Back sprained, fell from scaffold.
322	Dec. 22	Asbestos Corporation of Can. Ltd., British-Canadian Mine.	P. Gilbert	23	Labourer	Body bruised when struck by rock in open cast pit.
323	Dec. 22	The Pennington Asbestos Co.	Nap. Dulac	—	Carpenter	Left leg and side badly scratched and bruised when caught by shaft in the mill.
324	Dec. 27	Asbestos Corporation of Can. Ltd., King Mine.	Ant. Consiglis	43	Labourer	Right leg and both arms bruised when he fell in crusher.
325	Dec. 28	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	S. Perron	48	Foreman	While repairing a rope above ground fractured. finger of left hand.
326	Dec. 29	Consolidated Asbestos Ltd.	H. Létourneau	27	Shoveller	While rolling a rock into a cable-derrick box his feet slipped and caused the rock to roll back onto his knee bruising it.

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